

**CONTRACT DOCUMENTS AND SPECIFICATIONS**

**for**

**ADAPTIVE REUSE OF FORMER DOBLE USARC**

**Bid Proposal #30-19**

John P. Bohenko City Manager  
City of Portsmouth, New Hampshire

Prepared by:  
AECm, LLC  
13 Water Street  
Newmarket, NH 03857

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City of Portsmouth  
Portsmouth, New Hampshire  
Bid #30-19

**ADAPTIVE REUSE OF FORMER DOBLE USARC**

**INVITATION TO BID**

**Sealed** bid proposals, plainly marked, **ADAPTIVE REUSE OF FORMER DOBLE USARC** Bid Proposal #30-19 **on the outside of the mailing envelope as well as the sealed bid envelope**, addressed to the Finance/Purchasing Department, City Hall, 1 Junkins Avenue, Portsmouth, New Hampshire, 03801, will be accepted until **2:00 p.m. on July 1, 2019** at which time all bids will be publicly opened and read aloud.

A **mandatory** Pre-Bid Meeting and Walk-Through shall be conducted on **June 12, 2019 at 10:00 a.m.**, located at the former Paul A. Doble U.S. Army Reserve Center located at **125 Cottage Street**.

Questions regarding the project must be submitted in writing to Lori MacGinnis at [purchasing@cityofportsmouth.com](mailto:purchasing@cityofportsmouth.com) by **12:00 p.m. on June 18, 2019** and will be answered in the form of an addendum posted on the City's website <http://www.cityofportsmouth.com/finance/purchasing.htm> by **June 24, 2019 at 4:00 p.m.**

**PROJECT SYNOPSIS:** Adaptive reuse of existing facility for Portsmouth Senior Activity Center. Work involves site construction, total building renovation, and building entry addition.

Specifications may be obtained from the City's web site: <http://www.cityofportsmouth.com/finance/purchasing.htm>, by contacting the Finance/Purchasing Department on the third floor at the above address, or by calling the Purchasing Coordinator at 603-610-7227. Addenda to this bid document, if any, including written answers to questions, will be posted on the City of Portsmouth website at <http://www.cityofportsmouth.com/finance/purchasing.htm> under the project heading. Addenda and updates will **NOT** be sent directly to vendors. Questions may be addressed to the Purchasing Coordinator.

**All work shall be completed by April 30, 2020**. Liquidated damages shall be assessed at **\$800** per working day.

**The City reserves the right, after bid opening and prior to award of the contract, to modify the amount of the work in the event that bids exceed budgeted amounts.** The City of Portsmouth further reserves the right to reject any or all bids, to waive technical or legal deficiencies, to re-bid, and to accept any bid that it may deem to be in the best interest of the City.

Each Bidder shall furnish a bid security in the amount of ten percent (10%) of the bid. The Bid Security may be in the form of a certified check drawn upon a bank within the State of New Hampshire or a bid bond executed by a surety company authorized to do business in the State of New Hampshire, made payable to the City of Portsmouth, N.H.

## **INSTRUCTIONS TO BIDDERS**

### **BIDDING REQUIREMENTS AND CONDITIONS**

#### **1. Special Notice to Bidders**

Appended to these instructions is a complete set of bidding and general contract forms. These forms may be detached and executed for the submittal of bids. The plans, specifications, and other documents designated in the proposal form will be considered as part of the proposal, whether attached or not.

The bidders must submit a statement of bidder's qualifications, if requested, subsequent to bid opening but prior to award.

Addenda to this proposal, if any, including written answers to questions, will be posted on the City of Portsmouth website at <http://www.cityofportsmouth.com/finance/purchasing.htm> under the project heading. Addenda and updates will NOT be sent directly to firms. Contractors submitting a proposal should check the web site daily for addenda and updates after the release date. Firms should print out, sign and return addenda with the proposal. Failure to do so may result in disqualification

#### **2. Interpretation of Quantities in Bid Schedules**

The quantities appearing in the bid schedule are approximate only and are prepared for the comparison of bids. Payment to the contractor will be made only for actual work performed and accepted in accordance with the contract. Any scheduled item of work to be done and materials to be furnished may be increased, decreased or omitted as hereinafter provided, and no claim for loss, anticipated profits or costs incurred in anticipation of work not ultimately performed will be allowed due to such increase or decrease.

#### **3. Examination of Plans, Specifications and Site Work**

The bidder is expected to examine carefully the site of the proposed work, the plans, standard specifications, supplemental specifications, special provisions and contract forms before submitting a proposal. The submission of a bid shall be considered conclusive evidence that the bidder has made such examination and is satisfied as to the conditions to be encountered in performing the work and as to the requirements of the contract. It will be conclusive evidence that the bidder has also investigated and is satisfied with the sources of supply for all materials.

Plans, surveys, measurements, dimensions, calculations, estimates and statements as to the condition under which the work is to be performed are believed to be correct, but the contractors must examine for themselves, as no allowance will be made for any errors or inaccuracies that maybe found therein.

#### **4. Familiarity with Laws**

The bidder is assumed to have made himself or herself familiar with all federal and state laws and all local by-laws, ordinances and regulations which in any manner affect those engaged or employed on the work or affect the materials or equipment used in the work or affect the conduct of the work, and the bidder, if awarded the contract, shall be obligated to perform the work in conformity with said laws, by-laws, ordinances and regulations notwithstanding its ignorance thereof. If the bidder shall discover any provision in the plans or specifications which is in conflict with any such law, by-law, ordinance or regulation the bidder shall forthwith report it to the engineer in writing.

#### **5. Preparation of Proposal**

a) The bidder shall submit its proposal upon the forms furnished by the Owner. The bidder shall specify a lump sum price in figures, for each pay item for which a quantity is given and shall also show the products of the respective prices and quantities written in figures in the column provided for that purpose and the total amount of the proposal obtained by adding the amount of the several items. All words and figures shall be in ink or typed.

If a unit price or a lump sum bid already entered by the bidder on the proposal form is to be altered it should be crossed out with ink, the new unit price or lump sum bid entered above or below it and initialed by the bidder, also with ink.

b) The bidder's proposal must be signed with ink by the individual, by one or more general partners of a partnership, by one or more members or officers of each firm representing a joint venture; by one or more officers of a corporation, by one or more members (if member-managed) or managers (if manager-managed) of a limited liability company, or by an agent of the contractor legally qualified and acceptable to the owner. If the proposal is made by an individual, his or her name and post office address must be shown, by a partnership the name and post office address of each general and limited partner must be shown; as a joint venture, the name and post office address of each venturer must be shown; by a corporation, the name of the corporation and its business address must be shown, together with the name of the state in which it is incorporated, and the names, titles and business addresses of the president, secretary and treasurer.

#### 6. Nonconforming Proposals

Proposals will be considered nonconforming and may be rejected in the Owner's sole discretion for any of the following reasons:

- If the proposal is on a form other than that furnished by the Owner, or if the form is altered or any portion thereof is detached;
- If there are unauthorized additions, conditional or altered bids, or irregularities of any kind which may tend to make the proposal or any portion thereof incomplete, indefinite or ambiguous as to its meaning;
- If the bidder adds any provisions reserving the right to accept or reject an award, or to enter into a contract pursuant to an award; or
- If the proposal does not contain a unit price for each pay item listed except in the case of authorized alter pay items.

#### 7. Proposal Guaranty

No proposal will be considered unless accompanied by a bid bond, surety, or similar guaranty of the types and in an amount not less than 5%. All sureties shall be made payable to the "City of Portsmouth." If a bid bond is used by the bidder it shall be:

- In a form satisfactory to the Owner;
- With a surety company licensed, authorized to do business in, and subject to the jurisdiction of the courts of the State of New Hampshire; and
- Conditioned upon the faithful performance by the principal of the agreements contained in the sub-bid or the general bid.

In the event any irregularities are contained in the proposal guaranty, the bidder will have four business days (not counting the day of opening) to correct any irregularities. The corrected guaranty must be received by 4:00 p.m. If irregularities are not corrected to the satisfaction of the Owner, the Owner, in its sole discretion, may reject the bid.

#### 8. Delivery of Proposals

When sent by mail, the sealed proposal shall be addressed to the Owner at the address and in the care of the official in whose office the bids are to be received. All proposals shall be filed prior to the time and at the place specified in the invitation for bids. Proposals received after the time for opening of the bids will be returned to the bidder, unopened.

9. Withdrawal of Proposals

A bidder will be permitted to withdraw his or her proposal unopened after it has been submitted if the Owner receives a request for withdrawal in writing prior to the time specified for opening the proposals.

10. Public Opening of Proposals

Proposals will be opened and read publicly at the time and place indicated in the invitation for bids. Bidders, their authorized agents, and other interested parties are invited to be present.

11. Disqualification of Bidders

Any or all of the following reasons may be deemed by Owner in its sole discretion as being sufficient for the disqualification of a bidder and the rejection of his proposal:

- More than one proposal for the same work from an individual, firm, or corporation under the same or different name;
- Evidence of collusion among bidders;
- Failure to submit all required information requested in the bid specifications;
- Lack of competency or of adequate machinery, plant or other equipment, as revealed by the statement of bidders qualification or otherwise;
- Uncompleted work which, in the judgment of the owner, might hinder or prevent the prompt completion of additional work if awarded;
- Failure to pay, or satisfactorily settle, all bills due for labor and materials on former contracts;
- Default or unsatisfactory performance on previous contracts; or
- Such disqualification would be in the best interests of the Owner.

12. Material Guaranty and Samples

Before any contract is awarded, the bidder may be required to furnish a complete statement of the origin, composition and manufacture of any or all materials to be used in the construction of the work, and the Owner may, in its sole discretion, reject the bid based on the contents of the statement or as a result of the failure of the bidder to submit the statement.

## **AWARD AND EXECUTION OF CONTRACT**

### **1. Consideration of Proposals**

a) After the proposals are opened and read, they will be compared on the basis of the total price for all sections of work to be charged to perform the work and any such additional considerations as may be identified in the bid documents. The results of such comparisons will be immediately available to the public. In case of a discrepancy between the prices written in words and those written figures, the prices written in words shall govern. In case of a discrepancy between the total shown in the proposal and that obtained by adding the products of the quantities of items and unit bid prices, the latter shall govern.

b) The Owner reserves the right to reject any or all proposals, to waive technicalities or to advertise for new proposals, if, in the sole discretion of the Owner, the best interest of the City of Portsmouth will be promoted thereby.

### **2. Award of Contract**

If a contract is to be awarded, the award will be made to the lowest responsible and qualified bidder whose proposal complies with all the requirements prescribed. The successful bidder will be notified, in writing, mailed to the address on his or her proposal, that his or her bid has been accepted and that the bidder has been awarded the contract. Contract signing is anticipated to take place **within two (2) weeks following proposal submission.**

The award shall not be considered official until such time that a Purchase Order, fully executed contract or an award letter has been issued by the Finance Director. No presumption of award shall be made by the bidder until such documents are in hand. Verbal notification of award is not considered official. Any action by the bidder to assume otherwise is done so at his/her own risk and the City will not be held liable for any expense incurred by a bidder that has not received an official award.

### **3. Cancellation of Award**

The Owner reserves the right to cancel the award of any contract at any time before the execution of such contract by all parties without any liability of the Owner.

### **4. Return of Proposal Guaranty**

All proposal guaranties, except those of the three lowest bidders, will be returned upon request following the opening and checking of the proposals. The proposal guaranties of the three lowest bidders will be returned within ten days following the award of the contract if requested.

### **5. Contract Bonds**

At the time of the execution of the contract, the successful bidder shall furnish:

- Labor and materials payment bond in the sum equal to 100 percent of the contract amount.
- Performance bond in the sum equal to 100 percent of the contract amount.

At the time of project completion, the Owner may, in its sole discretion, permit the Contractor to substitute a maintenance bond in lieu of holding retainage for the entire guaranty period. If a bond is furnished it shall meet the following criteria:

- The bond shall be in an amount equal to 20 percent of the contract amount. Such bond shall guarantee the repair of all damage due to faulty materials or workmanship

provided or done by the contractor. The guarantee shall remain in effect for a period of one year after the date of final acceptance of the job by the Owner.

Each bond shall be: (1) in a form satisfactory to the Owner; (2) with a surety company licensed and authorized to do business and with a resident agent designated for services of process in the State of New Hampshire; and (3) conditioned upon the faithful performance by the principal of the agreements contained in the original bid. All premiums for the contract bonds are to be paid by the contractor.

6. Execution and Approval of Contract

The successful bidder is required to present all contract bonds, to provide proof of insurance, and to execute the contract within 10 days following receipt of the City's notification of acceptance of the bid. No contract shall be considered as in effect until it has been fully executed by all parties.

7. Failure to Execute Contract

Failure to execute the contract and file an acceptable bond within 10 days after notification of acceptance of bid shall be just cause for the cancellation of the award and the forfeiture of the proposal guarantee which shall become the property of the Owner, not as a penalty, but in liquidation of damages sustained. Award may then be made to the next lowest responsible bidder, or the work may be re-advertised as the Owner may determine in its sole discretion.

8. Additional Information

Requests for additional information or questions should be to Lori MacGinnis at [purchasing@cityofportsmouth.com](mailto:purchasing@cityofportsmouth.com) or 603-610-7227.

9. Reservation of Rights

The City reserves the right, after bid opening and prior to award of the contract, to modify the amount of the work in the event that bids exceed budgeted amounts. The City of Portsmouth further reserves the right to reject any or all bids, to waive technical or legal deficiencies, to re-bid, and to accept any bid that it may deem to be in the best interest of the City.



**PROPOSAL FORM**

**ADAPTIVE REUSE OF FORMER DOBLE USARC**

**CITY OF PORTSMOUTH, N.H.**

To the City of Portsmouth, New Hampshire, herein called the Owner.

The undersigned, as Bidder, herein referred to as singular and masculine declares as follows:

1. All interested in the Bid as Principals are named herein;
2. This bid is not made jointly, or in conjunction, cooperation or collusion with any other person, firm, corporation, or other legal entity;
3. No officer, agent or employee of the Owner is directly or indirectly interested in this Bid;
4. The bidder has carefully examined the sites of the proposed work and fully informed and satisfied himself as to the conditions there existing, the character and requirements of the proposed work, the difficulties attendant upon its execution and the accuracy of all estimated quantities stated in this Bid, and the bidder has carefully read and examined the Drawings, Agreement, Specifications and other Contract Documents therein referred to and knows and understands the terms and provisions thereof;
5. The bidder understands that the quantities of work calculated in the Bid or indicated on the Drawings or in the Specifications or other Contract Documents are approximate and are subject to increase or decrease or deletion as deemed necessary by the Portsmouth City Engineer. Any such changes will not result in or be justification for any penalty or increase in contract prices; and agrees that, if the Bid is accepted the bidder will contract with the Owner, as provided in the Contract Documents, this Bid Form being part of said Contract Documents, and that the bidder will supply or perform all labor, services, plant, machinery, apparatus, appliances, tools, supplies and all other activities required by the Contract Documents in the manner and within the time therein set forth, and that the bidder will take in full payment therefor the following item prices; and
6. It is the intention of this contract that the items listed above describe completely and thoroughly the entirety of the work as shown on the plans and as described in the specifications. All other items required to accomplish the above items are considered to be subsidiary work, unless shown as a pay item.

**PROPOSAL FORM**  
**CONSTRUCTION ITEMS**

<b><u>ITEM #</u></b>	<b><u>Est. Qty</u></b>	<b><u>Unit</u></b>	<b><u>ITEM DESCRIPTION</u></b>	<b><u>UNIT PRICE IN FIGURES</u></b>	<b><u>ITEM TOTAL IN FIGURES</u></b>
<b>BID ITEMS</b>					
<b>01</b>	1	EA	DIVISION 01 - General Requirements		
<b>02</b>	1	EA	DIVISION 02 - Site Work		
<b>03</b>	1	EA	DIVISION 03 - Concrete		
<b>04</b>	1	EA	DIVISION 04 - Masonry		
<b>05</b>	1	EA	DIVISION 05 - Metals		
<b>06</b>	1	EA	DIVISION 06 - Wood, Plastics, and Composites		
<b>07</b>	1	EA	DIVISION 07 - Thermal and Moisture Protection		
<b>08</b>	1	EA	DIVISION 08 - Openings		
<b>09</b>	1	EA	DIVISION 09 - Finishes		
<b>10</b>	1	EA	DIVISION 10 - Specialties		
<b>11</b>	1	EA	DIVISION 21 - Fire Suppression		
<b>12</b>	1	EA	DIVISION 22 - Plumbing		
<b>13</b>	1	EA	DIVISION 23 - Heating, Ventilation, and Air-Conditioning (HVAC)		
<b>14</b>	1	EA	DIVISION 26 - Electrical		
<b>15</b>	1	EA	DIVISION 28 - Electronic Safety and Security		
<b>16</b>	1	EA	DIVISION 31 - Earthwork		
<b>17</b>	1	EA	DIVISION 32 - Exterior Improvements		
				<b>TOTAL BASE BID: 1-17</b>	
<b>ALTERNATE BID ITEMS</b>					
<b>1</b>	1	EA	Concrete Slab Moisture Barrier System		
<b>2.1.a</b>	100	SF	Masonry Repointing – Brick		
<b>2.1.b</b>	100	SF	Masonry Repointing – CMU		
<b>2.2.a</b>	1	LF	Masonry Crack Repair – Brick		
<b>2.2.b</b>	1	LF	Masonry Crack Repair – CMU		
<b>2.2.c</b>	1	LF	Masonry Crack Repair – Concrete		
<b>2.3.a</b>	1	SF	Masonry Replacement – Brick		
<b>2.3.b</b>	1	SF	Masonry Replacement – CMU		
<b>2.4.a</b>	1	SF	CMU Infill		
<b>3.1</b>	1	EA	Structural Repairs – CMU/Bar Joist Connections		
<b>4.1</b>	700	SF	Roof replacement over kitchen connector		
<b>TOTAL ADD ALT ITEMS:</b>					

**TOTAL FOR PROJECT AND BASIS OF AWARD (includes proposal form items 1 thru 17 only)**

Total in Figures \$ \_\_\_\_\_

In Words \$ \_\_\_\_\_

The undersigned agrees that for extra work, if any, performed in accordance with the terms and provisions of the Contract Documents, the bidder will accept compensation as stipulated therein.

\_\_\_\_\_  
Date\_\_\_\_\_  
CompanyBy: \_\_\_\_\_  
Signature\_\_\_\_\_  
Business Address

Title: \_\_\_\_\_

\_\_\_\_\_  
City, State, Zip Code

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

The Bidder has received and acknowledged Addenda No. \_\_\_\_\_ through \_\_\_\_\_.

All Bids are to be submitted on this form and in a sealed envelope, plainly marked on the outside with the Bidder's name and address and the Project name as it appears at the top of the Proposal Form.

In order to follow the City's sustainability practices, future bid invitations/specifications may be sent electronically. Please provide an email address as to where I could email future bid invitations/specifications of this type. Thank you in advance for your cooperation.

Email Address: \_\_\_\_\_

**BID SECURITY BOND**

(This format provided for convenience, actual Bid Bond is acceptable in lieu of, if compatible.)

KNOW ALL MEN BY THESE PRESENTS, that we the undersigned

\_\_\_\_\_, as Principal, and

\_\_\_\_\_, as Surety, are hereby

held and firmly bound unto \_\_\_\_\_

IN THE SUM OF \_\_\_\_\_

as liquidated damages for payment of which, well and truly to be made we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

The condition of this obligation is such that whereas the Principal has submitted to the

\_\_\_\_\_ A CERTAIN Bid attached hereto and hereby made a part hereof to enter into a contract in writing, hereinafter referred to as the "AGREEMENT" and or "CONTRACT", for

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

NOW THEREFORE,

- (a) If said Bid shall be rejected or withdrawn as provided in the INFORMATION FOR BIDDERS attached hereto or, in the alternative,
- (b) If said Bid shall be accepted and the Principal shall duly execute and deliver the form of AGREEMENT attached hereto and shall furnish the specified bonds for the faithful performance of the AGREEMENT and/or CONTRACT and for the payment for labor and materials furnished for the performance of the AGREEMENT and or CONTRACT,

then this obligation shall be void , otherwise it shall remain in full force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder in no event shall exceed the amount of this obligation.

**BID SECURITY BOND** (continued)

The Surety, for value received, hereby agrees that the obligation of said surety and its bond shall be in no way impaired or affected by any extensions of the time within such BID may be accepted, and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the parties hereto have duly executed

this bond on the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

\_\_\_\_\_  
(Name of Principal) L.S.

(SEAL)

BY \_\_\_\_\_

\_\_\_\_\_  
(Name of Surety)

BY \_\_\_\_\_

**STATEMENT OF BIDDER'S QUALIFICATIONS**

**Note: This is a required submittal, fill out completely.**

All questions must be answered and the data given must be clear and comprehensive. This statement must be notarized. Add separate sheets if necessary

1. Name of Bidder
2. Permanent Main Office Address
3. Form of Entity
4. When Organized
5. Where Organized
6. How many years have you been engaged in the contracting business under your present name; also state names and dates of previous firm names, if any.
7. Contracts on hand; (schedule these, showing gross amount of each contract and the approximate anticipated dates of completion).
8. General character of work performed by your company.
9. Have you ever failed to complete any work awarded to you? \_\_\_\_\_(no)\_\_\_\_\_(yes). If so, where and why?
10. Have you ever defaulted on a contract?  
\_\_\_\_\_ (no) \_\_\_\_\_ (yes). If so, where and why?
11. Have you ever failed to complete a project in the time allotment according to the Contract Documents?  
\_\_\_\_\_ (no) \_\_\_\_\_ (yes). If so, where and why?
12. List the most important contracts recently executed by your company, stating approximate cost for each, and the month and year completed.
13. List your major equipment available for this contract.
14. List your key personnel such as project superintendent and foremen available for this contract.

**STATEMENT OF BIDDERS QUALIFICATIONS** (continued)

15. List any subcontractors whom you will use for the following (unless this work is to be done by your own organization, if so please state).
- a. Demolition \_\_\_\_\_
  - b. Roof Systems Installation \_\_\_\_\_
  - c. HVAC Systems Installation \_\_\_\_\_
  - d. OTHER \_\_\_\_\_
  - e. OTHER \_\_\_\_\_
  - f. OTHER \_\_\_\_\_
- (The City reserves the right to approve or reject subcontractors for this project)

16. With what banks do you do business?

- a. Do you grant the Owner permission to contact this/these institutions?  
 \_\_\_\_ (yes) \_\_\_\_ (no).

b. Latest Financial Statements, certified audited if available, prepared by an independent certified public accountant, may be requested by Owner. If requested, such statements must be provided within five (5) business days or the bid proposal will be rejected. Certified Audited Statement are preferred. Internal statements may be attached only if independent statements were not prepared.

Dated at \_\_\_\_\_ this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
 Name of Bidder

BY \_\_\_\_\_

TITLE \_\_\_\_\_

State of \_\_\_\_\_

County of \_\_\_\_\_

\_\_\_\_\_ being duly sworn, deposes and

says that the bidder is \_\_\_\_\_ of \_\_\_\_\_  
 (Name of Organization)

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

Sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
 Notary of Public

My Commission expires \_\_\_\_\_

## **CONTRACT AGREEMENT**

### **ADAPTIVE REUSE OF FORMER DOBLE USARC**

THIS AGREEMENT made as of the \_\_\_\_\_ in the year **2019**, by and between the City of Portsmouth, New Hampshire (hereinafter call the Owner) and \_\_\_\_\_ (hereinafter called the Contractor),

WITNESSETH; that the Owner and Contractor, in consideration of the mutual covenants hereinafter set forth, agree as follows:

**ARTICLE I- Work** - The Contractor shall perform all work as specified or indicated in the Contract Documents for the rehabilitation of the former Doble USARC. The Contractor shall provide, at his expense, all labor, materials, equipment and incidentals as may be necessary for the expeditious and proper execution of the Project.

**ARTICLE II - ENGINEER** - The Director of Public Works or his authorized representative will act as City Engineer in connection with completion of the Project in accordance with the Contract Documents.

**ARTICLE III - CONTRACT TIME** - The work shall commence in accordance with the Notice to Proceed. All Work shall be completed prior to **270 calendar days after notice to proceed.**

**ARTICLE IV - CONTRACT PRICE** Owner shall pay Contractor for performance of the work in accordance with the Contract Documents as shown under item prices in the Bid Proposal.

**ARTICLE V - PAYMENT** - Partial payments will be made in accordance with the Contract Documents. Upon final acceptance of the work and settlement of all claims, Owner shall pay the Contractor the unpaid balance of the Contract Price, subject to additions and deductions provided for in the Contract Documents.

**ARTICLE VI - RETAINAGE** - To insure the proper performance of this Contract, the Owner shall retain certain amounts in the percentage of the Contract Price and for the time specified as provided in the Contract Documents.

**ARTICLE VII - LIQUIDATED DAMAGES** - In event the Contractor fails to successfully execute the work within the specified contract time the Owner shall assess the Contractor liquidated damages in the amount of **EIGHT HUNDRED DOLLARS (\$800)** for each calendar day beyond the specified completion date for each section of work. Liquidated damages shall be deducted from the Contract Price prior to final payment of the Contractor.

**ARTICLE VIII – CONTRACT DOCUMENTS** – The Contract Documents which comprise the contract between Owner and Contractor are attached hereto and made a part hereof and consist of the following:

- 8.1 This Agreement
- 8.2 Contractor's Bid and Bonds
- 8.3 Notice of Award, Notice to Proceed
- 8.4 Instruction to Bidders
- 8.5 General Requirements, Control of Work, Temporary Facilities, Insurance Requirements, Measurement and Payment
- 8.6 Special Provisions for Building Access During Construction
- 8.7 Standard and Technical Specifications
- 8.8 Drawings



CDCONTRACT AGREEMENT (continued)

## 8.9 Special Provisions

## 8.10 Storm water Pollution Prevention Plan

## 8.11 Any modifications, including change orders, duly delivered after execution of this Agreement.

## 8.12 Appendices

**ARTICLE IX – TERMINATION FOR DEFAULT** – Should contractor at any time refuse, neglect, or otherwise fail to supply a sufficient number or amount of properly skilled workers, materials, or equipment, or fail in any respect to prosecute the work with promptness and diligence, or fail to perform any of its obligations set forth in the Contract, Owner may, at its election, terminate the employment of Contractor, giving notice to Contractor in writing of such election, and enter on the premises and take possession, for the purpose of completing the work included under this Agreement, of all the materials, tools and appliances belonging to Contractor, and to employ any other persons to finish the work and to provide the materials therefore at the expense of the Contractor.

**ARTICLE X – INDEMNIFICATION OF OWNER** – Contractor shall defend, indemnify and hold harmless Owner and its officials and employees from and against all suits, claims, judgments, awards, losses, costs or expenses (including without limitation attorneys' fees) to the extent arising out of or relating to Contractor's alleged negligence or breach of its obligations or warranties under this Contract. Contractor shall defend all such actions with counsel satisfactory to Owner at its own expense, including attorney's fees, and will satisfy any judgment rendered against Owner in such action.

**ARTICLE XI – PERMITS** – The Contractor shall secure at its own expense, all permits and consents required by law as necessary to perform the work and shall give all notices and pay all fees and otherwise comply with all applicable City, State, and Federal laws, ordinances, rules and regulations.

**ARTICLE XII – INSURANCE** – The Contractor shall secure and maintain, until acceptance of the work, insurance with limits not less than those specified in the Contract.

**ARTICLE XIII – MISCELLANEOUS** –

- A. Neither Owner nor Contractor shall, without the prior written consent of the other, assign, sublet or delegate, in whole or in part, any of its rights or obligations under any of the Contract Documents; and, specifically not assign any monies due, or to become due, without the prior written consent of Owner.
- B. Owner and Contractor each binds himself, his partners, successors, assigns and legal representatives, to the other party hereto in respect to all covenants, agreements and obligations contained in the Contract Documents.
- C. The Contract Documents constitute the entire Agreement between Owner and Contractor and may only be altered amended or repealed by a duly executed written instrument.
- D. The laws of the State of New Hampshire shall govern this Contract without reference to the conflict of law principles thereof.
- E. Venue for any dispute shall be the Rockingham County Superior Court unless the parties otherwise agree.

- F. Bidder will provide, or make available complete bid package to all subcontractors pricing work for the project. No separation of drawings will be allowed during the bidding phase. Bidder is responsible for a complete project delivery, and full coordination of scope with sub contractors.

IN WITNESS WHEREOF, the parties hereunto executed this AGREEMENT the day and year first above written.

**BIDDER:**

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

TITLE: \_\_\_\_\_

**CITY OF PORTSMOUTH, N.H.**

BY: \_\_\_\_\_  
John P. Bohenko

TITLE: City Manager

## NOTICE OF INTENT TO AWARD

Date:

To:

IN AS MUCH as you were the low responsible bidder for work entitled:

<b>ADAPTIVE REUSE OF FORMER DOBLE USARC</b>
---

You are hereby notified that the City intends to award the aforesaid project to you.

Immediately take the necessary steps to execute the Contract and to provide required bonds and proof of insurance **within fifteen (15) calendar days** from the date of this Notice.

The City reserves the right to revoke this Notice if you fail to take the necessary steps to execute this Contract.

City of Portsmouth  
Portsmouth, New Hampshire

Judie Belanger,  
Finance Director

**NOTICE TO PROCEED**

DATE:

PROJECT: ADAPTIVE REUSE OF FORMER DOBLE USARC

TO:

YOU ARE HEREBY NOTIFIED TO COMMENCE WORK IN ACCORDANCE  
WITH THE AGREEMENT DATED,

ALL WORK SHALL BE COMPLETED PRIOR TO **MONTH DAY, 2019.**

CITY OF PORTSMOUTH, N.H.

\_\_\_\_\_  
BY: Peter H. Rice

TITLE: Public Works Director

**ACCEPTANCE OF NOTICE**

RECEIPT OF THE ABOVE NOTICE TO  
PROCEED IS HEREBY ACKNOWLEDGED BY

\_\_\_\_\_  
This the \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_

By:\_\_\_\_\_

Title:\_\_\_\_\_

**CHANGE ORDER**

Change Order #  
Owner: CITY OF PORTSMOUTH, N.H

Date of Issuance:

Contractor:

You are directed to make the following changes in the Contract Documents:

Description:

Purpose of Change Order:

Attachments:

**CHANGE IN CONTRACT PRICE****CHANGE IN CONTRACT TIME**

Original Contract Price:  
\$

Original Completion Date:

Contract Price prior to this  
Change Order:  
\$

Contract Time prior to this  
Change Order:

Net Increase of  
this Change Order:  
\$

Net Increase or Decrease of  
this Change Order:

Contract Price with all  
approved Change Orders:  
\$

Contract Time with all  
approved Change Orders:

RECOMMENDED:  
APPROVED:

APPROVED:

by\_\_\_\_\_

by\_\_\_\_\_

by\_\_\_\_\_

by\_\_\_\_\_

PW Director

City Finance

City Manager

Contractor

**LABOR AND MATERIAL PAYMENT BOND**

(This format provided for convenience, actual Labor and Material Bond is acceptable in lieu, if compatible)

Bond Number \_\_\_\_\_

KNOW ALL MEN BY THESE PRESENTS:

that \_\_\_\_\_

as Principal, hereinafter called Contractor, and \_\_\_\_\_ (Surety Company) a corporation organized and existing under the laws of the State of

\_\_\_\_\_ and authorized to do business in the State of New Hampshire hereinafter called Surety, are held and firmly bound unto the City of Portsmouth, N.H. Obligee, hereinafter called Owner, for the use and benefit of claimants as herein below defined, in the

amount of \_\_\_\_\_ Dollars (\$\_\_\_\_\_), for the payment whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Principal has by written agreement dated \_\_\_\_\_ entered into a contract with Owner for \_\_\_\_\_ in accordance with drawings and specifications prepared by the Public Works Department, 680 Peverly Hill Road, Portsmouth, N.H. 03801, which contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that the Principal shall promptly make payment to all claimants as hereinafter defined, for all labor and material used or reasonably required for use in the performance of the Contract and for the hire of all equipment, tools, and all other things contracted for or used in connection therewith, then this obligation shall be void, otherwise it shall remain in full force and effect, subject however, to the following conditions:

(1) A claimant is defined as one having a direct contract with the Principal or, with a subcontractor of the Principal for labor, material, equipment, or other things used or reasonably required for use in the performance of the Contract. "Labor and material" shall include but not be limited to that part of water, gas, power, light, heat, oil and gasoline, telephone service or rental of equipment applicable to the Contract.

(2) The above named Principal and Surety hereby jointly and severally agree with the Owner that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after the date on which the last of such claimant's work or labor was done or performed, or materials were furnished by such a claimant, may sue on this bond for the use of such claimant, prosecute the suit by final judgment for such sum or sums as may be

**LABOR AND MATERIAL PAYMENT BOND** (continued)

justly due claimant, and have execution thereon. The Owner shall not be liable for the payment of any such suit or any costs or expenses of any such suit, and principal and surety shall jointly and severally indemnify, defend and hold the Owner harmless for any such suit, costs or expenses.

(3) No suit or action shall be commenced hereunder by any claimant:

(a) Unless Claimant, other than one having a direct contract with the Principal, shall have given notice to all the following:

The Principal, the Owner and the Surety above named, within six (6) calendar months after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the Principal, Owner, and Surety, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the State of New Hampshire save that such service need not be made by a public officer.

(b) After the expiration of one (1) year following the date on which Principal ceased all work on said contract, it being understood, however, that if any limitation embodied in this bond is prohibited by any law controlling the construction hereof, such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

(c) Other than in a State court of competent jurisdiction in and for the county or other political subdivision of the State in which the project, or any part thereof, is situated, or in the United States District Court for the district in which the project, or any part thereof, is situated, and not elsewhere. (4) The amount of this bond may be reduced by and to the extent of any payment of payments made in good faith hereunder, inclusive of the payment by Surety of mechanics' liens which may be filed on record against said improvement, whether or not claim for the amount of such lien by presented under and against this bond.

Signed and sealed this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_. In the presence of:

\_\_\_\_\_  
(Witness) BY: \_\_\_\_\_  
(Principal) (Seal)

\_\_\_\_\_  
(Surety Company)

\_\_\_\_\_  
(Witness) BY: \_\_\_\_\_  
(Title) (Seal)

**LABOR AND MATERIAL PAYMENT BOND** (continued)

Note:

If the Principal (Contractor) is a partnership, the Bond should be signed by each of the partners.

If the Principal (Contractor) is a corporation, the Bond should be signed in its correct corporate name by its duly authorized Officer or Officers.

If this bond is signed on behalf of the Surety by an attorney-in-fact, there should be attached to it a duly certified copy of his Power of Attorney showing his authority to sign such Bonds.

There should be executed an appropriate number of counterparts of the bond corresponding to the number of counterparts of the Agreement.



**MAINTENANCE BOND**

At the Owner's election, a maintenance bond may be substituted for retainage at the completion of the project. If the Owner permits a maintenance bond, it shall be in the amount of **Twenty Percent (20%)** of the contract price with a corporate surety approved by the Owner. Such bond shall be provided at the time of Contract completion and shall guarantee the repair of all damage due to faulty materials or workmanship provided or done by the Contractor. This guarantee shall remain in effect for a period of one year after the date of final acceptance of the job by the Owner.

**CONTRACTOR'S AFFIDAVIT**

STATE OF \_\_\_\_\_:

COUNTY OF \_\_\_\_\_:

Before me, the undersigned, a \_\_\_\_\_  
(Notary Public, Justice of the Peace)

in and for said County and State personally appeared, \_\_\_\_\_  
(Individual, Partner, or duly authorized representative of Corporate)

who, being duly sworn, according to law deposes and says that the cost of labor, material, and equipment and outstanding claims and indebtedness of whatever nature arising out of the performance of the Contract between

CITY OF PORTSMOUTH, NEW HAMPSHIRE

and \_\_\_\_\_  
(Contractor)

of \_\_\_\_\_

Dated: \_\_\_\_\_

has been paid in full for Construction of:

**ADAPTIVE REUSE OF FORMER DOBLE USARC**

\_\_\_\_\_  
(Individual, Partner, or  
duly authorized  
representative of  
Corporate Contractor)

Sworn to and subscribed  
before me this \_\_\_\_\_ day  
of \_\_\_\_\_ 20\_\_\_\_

\_\_\_\_\_

**CONTRACTOR'S RELEASE**

KNOW ALL MEN BY THESE PRESENTS that

\_\_\_\_\_  
 \_\_\_\_\_, County of \_\_\_\_\_ and State of \_\_\_\_\_  
 \_\_\_\_\_ does hereby acknowledge  
 that \_\_\_\_\_ (Contractor)

has on this day had, and received from the CITY OF PORTSMOUTH NEW HAMPSHIRE, final  
 and completed payment for the Construction of:

**ADAPTIVE REUSE OF FORMER DOBLE USARC**

NOW THEREFORE, the said \_\_\_\_\_

(Contractor)

for myself, my heirs, executors, and administrators) (for itself, its successors and assigns)  
 do/does by these presents remise, release, quit-claim and forever discharge the City of  
 Portsmouth, New Hampshire, its successors and assigns, of and from all claims and demands  
 arising from or in connection with the said Contract dated \_\_\_\_\_, and of and from  
 all, and all manners of action and actions, cause and causes of action and actions, suits, debts,  
 dues, duties, sum and sums of money, accounts, reckonings, bonds, bills, specifications,  
 covenants, contracts, agreements, promises, variances, damages, judgments, extents, executions,  
 claims and demand, whatsoever in law of equity, or otherwise, against the City of Portsmouth,  
 New Hampshire, its successors and assigns, which (I, my heirs, executors, or administrators) (it,  
 its successors and assigns) ever had, now have or which (I, my heirs, executors, or  
 administrators) (it, its successors and assigns) hereafter can shall or may have, for, upon or by  
 reason of any matter, cause, or thing whatsoever; from the beginning of record time to the date of  
 these presents.

IN WITNESS WHEREOF,

Contractor:

\_\_\_\_\_  
 print name of witness: \_\_\_\_\_

By: \_\_\_\_\_  
 Its Duly Authorized \_\_\_\_\_

Dated: \_\_\_\_\_

## **GENERAL REQUIREMENTS**

### **SCOPE OF WORK**

#### **1. INTENT OF CONTRACT**

The intent of the Contract is to provide for the construction and completion in every detail of the work described. The Contractor shall furnish all labor, materials, equipment, tools, transportation and supplies required to complete the work in accordance with the terms of the Contract. The Contractor shall be required to conform to the intent of the plans and specifications. No extra claims shall be allowed for portions of the work not specifically addressed in the plans and specifications but required to produce a whole and complete project, such work will be considered subsidiary to the bid items.

#### **2. INCIDENTAL WORK**

Incidental work items for which separate payment is not measured includes, but is not limited to, the following items:

- a. Mobilization & Demobilization
- b. Clean up
- c. Temporary Facilities
- d. Transportation and disposal of demolition debris and waste materials
- f. Restoration of property
- g. Cooperation with other contractors, abutters and utilities.
- h. Accessories and fasteners or components required to make items paid for under unit prices or lump sum items complete and functional.

#### **3. ALTERATION OF PLANS OR OF CHARACTER OF WORK**

The Owner reserves the right, without notice to Surety, to make such alterations of the plans or of the character of the work as may be necessary or desirable to complete fully and acceptably the proposed construction; provided that such alterations do not increase or decrease the contract cost. Within these cost limits, the alterations authorized in writing by the Owner shall not impair or affect any provisions of the Contract or bond and such increases or decreases of the quantities as a result from these alterations or deletions of certain items, shall not be the basis of claim for loss or for anticipated profits by the contractor. The contractor shall perform the work as altered at the contract unit price or prices.

#### **4. EXTRA WORK ITEMS**

Extra work shall be performed by the Contractor in accordance with the specifications and as directed, and will be paid for at a price as provided in the Contract documents or if such pay items are not applicable than at a price negotiated between the contractor and the Owner or at the unit bid price. If the Owner determines that extra work is to be performed, a change order will be issued.

#### **5. CHANGE ORDERS**

The Owner reserves the right to issue a formal change order for any increase, decrease, deletion, or addition of work or any increase in contract time or price. The contractor shall be required to sign the change order and it shall be considered as part of the Contract documents.

#### **6. FINAL CLEANING UP**

Before acceptance of the work, the contractor shall remove from the site all machinery, equipment, surplus materials, rubbish, temporary buildings, barricades and signs. All parts of the work shall be left in a neat and presentable condition. On all areas used or occupied by the contractor, regardless of the contract limits, the bidder shall clean-up all sites and storage grounds.

The items prescribed herein will not be paid for separately, but shall be paid for as part of the total contract price.

#### 7. ERRORS AND INCONSISTENCY IN CONTRACT DOCUMENTS

Any provisions in any of the Contract Documents that may be in conflict with the paragraphs in these General Requirements shall be subject to the following order of precedence for interpretation.

1. Technical Specifications will govern General Requirements.
2. Special Provisions will govern Technical Specifications.
3. Plans will govern Special Provisions, Technical Specifications, and General Requirements.

## **CONTROL OF WORK**

### **1. AUTHORITY OF ENGINEER**

(a) All work shall be done under supervision of the City Engineer and to his satisfaction. The City Engineer will decide all questions which may arise as to the quality and acceptability of materials furnished and work performed and as to the rate of progress of the work; all questions that may arise as to the interpretation of the plans and specifications; and all questions as to the acceptable fulfillment of the Contract by the Contractor.

(b) The City Engineer will have the authority to suspend the work wholly or in part for such periods as he may deem necessary due to the failure of the Contractor to correct conditions unsafe for workers or the general public; for failure to carry out provisions of the Contract; for failure to carry out orders; for conditions considered unsuitable for the prosecution of the work, including unfit weather; or for any other condition or reason deemed to be in the public interest. The Contractor shall not be entitled any additional payments arising out of any such suspensions.

(c) The Owner reserves the right to demand a certificate of compliance for a material or product used on the project. When the certificate of compliance is determined to be unacceptable to the City Engineer the Contractor may be required to provide engineering and testing services to guarantee that the material or product is suitable for use in the project, at its expense (see Sample of Certificate of Compliance).

### **2. PROTECTION AND RESTORATION OF PROPERTY AND LANDSCAPES**

(a) The Contractor shall use every precaution to prevent injury or damage to buildings, pavement, wires, poles, or other property of public utilities; trees, shrubbery, crops, and fences along and adjacent to the right-of-way, all underground structures such as pipes and conduits, within or outside of the right-of-way; and the Contractor shall protect and carefully preserve all property marks until an authorized agent has witnessed or otherwise referenced their location.

(b) The Contractor shall be responsible for all damage or injury to property of any character, during the prosecution of the work, resulting from any act, omission, neglect, or misconduct in his manner or method of executing the work, or at any time due to defective work or materials, and said responsibility will not be released until the project shall have been completed and accepted.

(c) When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work, or as a result of the failure to perform work by the Contractor, the Contractor shall restore, at its own expense, such property to a condition similar or equal to that existing before such damage or injury was done, by repairing rebuilding, or otherwise restoring as may be directed, or the Contractor shall make good such damage or injury in an acceptable manner.

(d) If the Contractor fails to repair, rebuild or otherwise restore such property as may be deemed necessary, the Owner, after 48 hours notice, may proceed to do so, and the cost thereof may be deducted from any money due or which may become due the Contractor under the contract.

**CONTROL OF WORK** (continued)

(f) It is the intent of the Parties that the Contractor preserve, to as great an extent as possible, the natural features of the site.

(g) All facilities, infrastructure and features shall be protected and preserved during construction. Any damaged items shall be repaired or replaced by the contractor at no cost to the owner.

**3. MAINTENANCE DURING CONSTRUCTION**

The Contractor shall maintain the work during construction and until the project is accepted. This maintenance shall constitute continuous and effective work prosecuted day by day, with adequate equipment and workers to ensure that the structure is kept in satisfactory conditions at all times.

**4. SAFETY PRECAUTIONS**

Upon commencement of work, the Contractor shall be responsible for initiating, maintaining and supervising all safety precautions necessary to ensure the safety of employees on the site, other persons who may be affected thereby, including the public, and other property at the site or adjacent thereto.

**5. PERMITS**

It will be the responsibility of the Contractor to obtain all permits required for the operation of equipment in, on, all city streets and public ways.

**6. BARRICADES, WARNING SIGNS AND TRAFFIC OFFICERS**

(a) The Contractor shall provide, erect and maintain all necessary barricades, suitable and sufficient lights, danger signals, signs and other traffic control devices, and shall take all necessary precautions for the protection of the work and safety of the public. Roadway closed to traffic shall be protected by effective barricades. Obstructions shall be illuminated during hours of darkness. Suitable warning signs shall be provided to control and direct traffic in a proper manner, as approved by the engineer.

(b) The Contractor will be held responsible for all damage to the work from traffic, pedestrians, animals or any other cause due to lack of adequate controlling devices.

(c) The Contractor shall provide such police officers as the City Engineer deems necessary for the direction and control of traffic within the site of project.

The work prescribed herein will not be paid for separately but will be paid for as part of the Contract Price unless specifically appearing as a bid item.

## **TEMPORARY FACILITIES**

### **1. STORAGE FACILITIES**

(a) The Contractor shall not store materials or equipment in a public right-of-way beyond the needs of one working day. Equipment and materials shall be stored in an approved location.

(b) The Contractor shall protect all stored materials from damage by weather or accident and shall insure adequate drainage at and about the storage location.

(c) Prior to final acceptance of the work all temporary storage facilities and surplus stored materials shall be removed from the site.

### **2. SANITARY FACILITIES**

(a) The Contractor shall provide for toilet facilities for the use of the workers employed on the work.

(b) Temporary toilet facilities may be installed provided that the installation and maintenance conform with all State and local laws, codes, regulations and ordinances governing such work. They shall be properly lit and ventilated, and shall be kept clean at all times.

(c) Prior to final acceptance of the work all temporary toilet facilities shall be removed from the site.

### **3. TEMPORARY WATER**

The Contractor shall make all arrangements with the local water department for obtaining water connections to provide the water necessary for construction operations and shall pay all costs.

### **4. TEMPORARY ELECTRICITY**

The Contractor shall make all arrangements with the Public Service Company for obtaining electrical connections to provide the electrical power necessary for construction operations and security lighting and shall pay all electrical connection and power costs.

The Contractor shall be responsible with obtaining an electrical permit from the City Electrical Inspector.



### **INSURANCE REQUIREMENTS**

Insurance shall be in such form as will protect the Contractor from all claims and liabilities for damages for bodily injury, including accidental death, and for property damage, which may arise from operations under this contract whether such operation by himself or by anyone directly or indirectly employed by him.

#### **AMOUNT OF INSURANCE**

- A) Comprehensive General Liability:  
Bodily injury or Property Damage - \$2,000,000  
Per occurrence and general aggregate
- B) Automobile and Truck Liability:  
Bodily Injury or Property Damage - \$2,000,000  
Per occurrence and general aggregate

Additionally, the Contractor shall purchase and maintain the following types of insurance:

- A) Workers Comprehensive Insurance coverage sufficient to meet statutory requirements for all people employed by the Contractor to perform work on this project.
- B) Contractual Liability Insurance coverage in the amounts specified above under Comprehensive General Liability.
- C) Product and Completed Operations coverage to be included in the amounts specified above under Comprehensive General Liability.

#### **ADDITIONAL INSURED**

All liability policies (including any excess policies used to meet coverage requirements) shall include the City of Portsmouth, New Hampshire as named Additional Insured.

- 1) The contractor's insurance shall be primary in the event of a loss.
- 2) The Additional Insured endorsement must include language specifically stating that the entity is to be covered for all activities performed by, or on behalf of, the contractor, including the City of Portsmouth's general supervision of the contractor.
- 3) City of Portsmouth shall be listed as a Certificate Holder and Additional Insured. The City shall be identified as follows:

City of Portsmouth  
Attn: Legal Department  
1 Junkins Avenue  
Portsmouth, NH 03801

## **MEASUREMENT AND PAYMENT**

### **1. MEASUREMENT OF QUANTITIES**

(a) All work completed under the contract will be measured according to the United States standard measure.

(b) The method of measurement and computations to be used in determination of quantities of material furnished and of work performed under the contract will be those methods generally recognized as conforming to good engineering practice. Unless otherwise stated all quantities measured for payment shall be computed or adjusted for "in place" conditions.

(c) Unless otherwise specified, longitudinal measurements for area computations will be made horizontally, and no deductions will be made for individual fixtures having an area of 9 square feet or less. Unless otherwise specified, transverse measurements for area computations will be the dimensions shown on the plans or ordered in writing.

(d) Structures will be measured according to lines shown on the plans or as ordered unless otherwise provided for elsewhere in the specifications.

(e) Removal and replacement of existing roof membrane and insulation shall be reimbursed at unit price per square foot as measured in-place.

(f) The term "lump sum" when used as an item of payment will mean complete payment for the work described in the item.

(g) When a complete structure or structural unit (in effect, "lump sum" work) is specified as the unit of measurement, the unit will be construed to include all necessary fittings and accessories, so as to provide the item complete and functional. Except as may be otherwise provided, partial payments for lump sum items will be made approximately in proportion to the amount of the work completed on those items.

(h) Material wasted without authority will not be included in the final estimate.

### **2. SCOPE OF PAYMENT**

(a) The Contractor shall receive and accept compensation provided for in the contract as full payment for furnishing all materials and for performing all work under the contract in a complete and acceptable manner and for all risk, loss, damage or expense of whatever character arising out of the nature of the work or the prosecution thereof.

(b) The Contractor shall be liable to the Owner for failure to repair, correct, renew or replace, at his own expense, all damage due or attributable to defects or imperfections in the construction which defects or imperfections may be discovered before or at the time of the final inspection and acceptance of the work.

(c) No monies, payable under the contract or any part thereof, except the first estimate, shall become due or payable if the Owner so elects, until the Contractor shall satisfy the Owner that the Contractor has fully settled or paid all labor performed or furnished for all equipment hired, including trucks, for all materials used, and for fuels, lubricants, power tools, hardware and supplies purchased by the Contractor and used in carrying out said contract and for labor and parts furnished upon the order of said Contractor for the repair of equipment used in carrying out said contract; and the Owner, if he so elects, may pay any and all such bills, in whole or in part, and deduct the amount of amounts so paid from any partial or final estimate, excepting the first estimate.

### 3. COMPENSATION FOR ALTERED QUANTITIES

(a) Except as provided for under the particular contract item, when the accepted quantities of work vary from the quantities in the bid schedule the Contractor shall accept as payment in full, so far as contract items are concerned, at the original contract unit prices for the accepted quantities of work done. No allowance will be made for any increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor resulting either directly from such alterations or indirectly from unbalanced allocation among the contract items of overhead expense on the part of the Bidder and subsequent loss of expected reimbursements therefore or from any other cause.

(b) Extra work performed will be paid for at the contract bid prices or at the price negotiated between the Owner and the Contractor if the item was not bid upon. If no agreement can be negotiated, the Contractor will accept as payment for extra work, cost plus 15% (overhead and profit). Costs shall be substantiated by invoices and certified payroll.

### 4. PARTIAL PAYMENTS

Partial payments will be made on a monthly basis during the contract period. From the total amount ascertained as payable, an amount equivalent to ten percent (10%) of the whole will be deducted and retained by the Owner up until fifty percent (50%) completion of the work. Five Percent (5%) of the whole will be deducted and retained by the Owner up until substantial completion. At which point the Contractor can request a reduction down to two percent (2%) in accordance with Final Payment.

### 5. FINAL ACCEPTANCE

Upon due notice from the Contractor of presumptive completion of the entire project, the City Engineer will make an inspection. If all construction provided for and contemplated by the contract is found complete to his satisfaction, this inspection shall constitute the final inspection and the City Engineer will make the final acceptance and notify the Contractor in writing of this acceptance as of the date of the final inspection.

If, however, the inspection discloses any work in whole or in part, as being unsatisfactory, the City Engineer will give the Contractor the necessary instructions for correction of such work, and the Contractor shall immediately comply with and execute such instructions. Upon correction of the work, another inspection will be made which shall constitute the final inspection provided the work has been satisfactorily completed. In such event, the City Engineer will make the final acceptance and notify the Contractor in writing of this acceptance as of the date of final inspection.

### 6. ACCEPTANCE AND FINAL PAYMENT

(a) When the project has been accepted and upon submission by the Contractor of all required reports, completed forms and certifications, the Owner will review the final estimate of the quantities of the various classes of work performed. The Contractor may be required to certify that all bills for labor and material used under this contract have been paid.

(b) The Contractor shall file with the Owner any claim that the Contractor may have regarding the final estimate at the same time the Contractor submits the final estimate. Failure to do so shall be a waiver of all such claims and shall be considered as acceptance of the final estimate. From the total amount ascertained as payable, an amount equivalent to ten percent (10%) of the whole will be deducted and retained by the Owner up until fifty percent (50%) completion of the work. Five Percent (5%) of the whole will be deducted and retained by the Owner up until substantial completion. At which point the Contractor can request a reduction

down to two percent (2%) in accordance with Final Payment. This retainage may be waived, at the discretion of the City, provided the required Maintenance Bond has been posted. After approval of the final estimate by the Owner, the Contractor will be paid the entire sum found to be due after deducting all previous payments and all amounts to be retained or deducted under the provisions of the contract.

(c) All prior partial estimates and payments shall be subject to correction in the final estimate and payment.

## 7. GENERAL GUARANTY AND WARRANTY OF TITLE

(a) Neither the final certification of payment nor any provision in the contract nor partial or entire use of the improvements embraced in this Contract by the Owner or the public shall constitute an acceptance of work not done in accordance with the Contract or relieve the Contractor of liability in respect to any express or implied warranties or responsibility for faulty materials or workmanship. The Contractor shall promptly remedy any defects in the work and pay for any damage to other work resulting therefrom which shall appear within a period of twelve (12) months from the date of final acceptance of the work. The Owner will give notice of defective materials and work with reasonable promptness.

(b) No material, supplies or equipment to be installed or furnished under this Contract shall be purchased subject to any chattel mortgage or under a conditional sale, lease purchase or other agreement by which an interest therein or in any part thereof is retained by the Seller or supplier. The Contractor shall warrant good title to all

materials, supplies and equipment installed or incorporated in the work and upon completion of all work, shall deliver the same together with all improvements and appurtenances constructed or placed thereon by him to the Owner free from any claims, liens or charges. Neither the Contractor nor any person, firm or corporation furnishing any material or labor for any work covered by this Contract shall have the right to a lien upon any improvements or appurtenances thereon.

Nothing contained in this paragraph, however, shall defeat or impair the right of persons furnishing materials or labor to recover under any bond given by the Contractor for their protection or any rights under any law permitting such persons to look to funds due the Contractor in the hands of the Owner. The provisions of this paragraph shall be inserted in all subcontractors and material contracts and notice of its provisions shall be given to all persons furnishing materials for the work when no formal contract is entered into for such materials.

## 8. NO WAIVER OF LEGAL RIGHTS

(a) Upon completion of the work, the Owner will expeditiously make final inspection and notify the Contractor of acceptance. Such final acceptance, however, shall not preclude or stop the Owner from correcting any measurement, estimate, or certificate made before or after completion of the work, nor shall the Owner be precluded or be stopped from recovering from the Contractor or his Surety, or both, such overpayment as it may sustain by failure on the part of the Contractor to fulfill his obligations under the contract. A waiver on the part of the Owner of any breach of any part of the contract shall not be held to be a waiver of any other or subsequent breach.

(b) The Contractor, without prejudice to the Contract shall be liable to the terms of the Contract, shall be liable to the Owner for latent defects, fraud or such gross mistakes as may amount to fraud, and as regards the Owner's right under any warranty or guaranty.

## 9. TERMINATION OF CONTRACTOR'S RESPONSIBILITY

Whenever the improvement provided for by the Contract shall have been completely performed on the part of the Contractor and all parts of the work have been released from further obligations except as set forth in his bond and as provided in Section 8 above.

## **STANDARD SPECIFICATIONS**

**Refer to the Technical Specifications.**

**SHOP DRAWINGS**

Shop Drawings for this project shall be submitted under the following conditions:

1. The Contractor shall submit working and detail drawings, well in advance of the work, to the City Engineer for review.
2. The Contractor's drawings shall consist of shop detail, erection and other working plans showing dimensions, sizes and quality of material, details and other information necessary for the complete fabrication and erection of the pertinent work.
3. The Contractor shall submit two (2) sets of drawings to the City Engineer.
4. Prior to the approval of the drawings, any work done or materials ordered for the work involved shall be at the Contractor's risk.
5. One (1) set of the drawings will be returned to the Contractor approved or marked with corrections to be made. After approval has been given, the Contractor shall supply the City Engineer with two sets of the revised detail working drawings.
6. The City Engineer's approval of the Contractor's working drawings will not relieve the Contractor from responsibility for errors in dimensions or for incorrect fabrication processes, or from responsibility to complete the contract work.

## **TECHNICAL SPECIFICATIONS**



**CONTRACT DRAWINGS**

# CONSTRUCTION SPECIFICATIONS

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## Portsmouth Senior Activity Center

## Adaptive Reuse of former Doble U.S. Army Reserve Center

125 Cottage Street  
Portsmouth, NH 03801

February 2019 (REV 04)

*Prepared for:*

City of Portsmouth, NH  
1 Junkins Avenue  
Portsmouth, NH 03801



*Prepared by:*

AECm architects | engineers  
13 Water Street  
Newmarket, NH 03857



Manypenny Murphy Architecture  
96 Penhallow Street  
Portsmouth, NH 03801

**MANYPENNY | MURPHY ARCHITECTURE**

Becker Structural Engineers  
75 York Street  
Portland, ME 04101



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**SECTION 01 00 00  
GENERAL REQUIREMENTS**

**PART 1 – GENERAL**

**1.1 DESCRIPTION**

- A. The General Conditions, Supplementary General Conditions and Special Conditions of this Contract shall apply to each and every contract and contractor or other person or persons supplying labor, material, equipment and/or services entering into this Project and/or on the premises directly or indirectly.
- B. Definitions:
  - 1. The word “Contractor” where used throughout this document to describe the General Contractor, shall also mean the “Construction Manager”, both Contractor and Construction Manager describing the entity holding the prime Contract for Construction.
- C. Work Included in This Contract:
  - 1. Providing all labor, materials, equipment, and services, etc., as required to properly complete all Work identified in, implied by or otherwise required by the Contract Documents.
  - 2. Should the Construction Documents disagree in themselves or with each other, the Contractor shall provide the better quality or greater quantity of work and/or materials, unless specifically otherwise directed by written Addendum to the Contract.
  - 3. The Contractor and all subcontractors shall refer to all of the Construction Documents, including those not specifically showing the Work of their specialized trades, and shall perform all work reasonably inferable from them as being necessary to produce the intended results.
- D. Work Excluded from This Contract:
  - 1. Providing equipment noted as “Not in Contract” (N.I.C.) or “By Owner,” (B.O.). The Contractor shall, however, provide services and coordination related to items not in the Contract as otherwise required or implied by the Contract Documents.

**1.2 GENERAL RESPONSIBILITIES OF THE CONTRACTOR**

- A. Regulations: The Contractor shall fully comply with all governing Local, State and Federal Laws, Codes, Rules, Regulations and Ordinances, including but not limited to The Americans with Disabilities Act, Equal Employment Opportunity and Affirmative Action provisions, and Occupational Safety and Health Administration provisions.
- B. Permits: The Contractor shall obtain and pay for all permits and arrange for necessary inspections and approvals from the authorities having jurisdiction. Should any changes be necessary in the Contract Documents to secure such approvals, the Contractor shall promptly notify the Architect.
  - 1. For the Owner’s records, submit copies of permits, licenses, inspection reports, certifications, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing on the Work.
- C. Coordination: The Contractor shall be fully responsible for coordinating all construction activities to assure efficient and orderly installation of each part of the Work. In general coordination duties shall include, but not be limited to verifying dimensions and existing field conditions, coordinating construction operations, establishing on-site lines of authority and communication, monitoring schedules and progress, monitoring quality, maintaining records and reports and in general assuring the proper administration of the Work.
  - 1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.

2. Where installation of a component or system involves installation of component parts by multiple subcontractors, the Contractor shall inventory, store, and distribute parts to appropriate installers.
  3. Where structural, electrical, or mechanical components such as columns, ductwork, sprinkler piping, or raceways are installed in finished spaces, the intent is for room finish to enclose such components unless indicated otherwise. Coordinate between the trades and with the Architect.
  4. Where inspections or approval of a substrate or component to be concealed by another is required, coordinate construction activities and notification of Architect or inspecting party. Do not conceal substrate or component until it has been inspected and is satisfactory.
  5. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for maintenance, service, and repair.
  6. Make adequate provision to accommodate items scheduled for later installation.
  7. Coordinate completion and clean-up of Work in preparation of Substantial Completion.
  8. Special attention called toward coordination of all work in relationship to the required phasing of work to accommodate ongoing building occupation by Owner.
- D. Supervision – Construction Superintendent: The Contractor shall place and maintain a competent, experienced construction Superintendent/Foreman in charge of the Work on the job site at all times while work is in progress, including overtime operations by the Contractor's forces or by subcontractors. No changes in this position shall be made without the Owner's prior approval. The Owner shall have the right to review the qualifications of the proposed Superintendent/Foreman and ask for a replacement if in his opinion the person does not meet the qualifications that the project will demand. The same superintendent who was in charge during the general progress of the Work shall oversee the completion of all punch list items.
1. The Contractor shall be responsible for the strict enforcement of the following requirements:
    - a. All persons working on the Project site shall be required to conduct themselves in a courteous and professional manner. The use of profane language shall be strictly prohibited.
    - b. Smoking and alcoholic beverages shall be strictly prohibited on the Project site.
    - c. The use of radios, etc. shall be strictly regulated if they interfere with the Owner's ongoing building operation.
    - d. Contact with building occupants and visitors shall be minimized to the extent necessary for the safe and proper execution of the Work.
    - e. All construction personnel shall be issued identification badges by the Contractor, which shall be conspicuously displayed at all times while on the construction site.
  2. The Contractor shall designate a representative who will be available to respond to emergency calls by the Owner at any time of day and night, weekends and holidays should such a situation arise
- E. On-Site Documents: The Contractor shall provide in a visible and accessible location in the on-site office:
1. Complete, currently updated set of Specifications and Drawings, Change Orders, reviewed Shop Drawings, and other documents and samples.
  2. Permits and notifications required by laws and regulations.
  3. Standards, manuals, installation instructions, or reports required by individual Specification sections.
  4. Product MSDS Sheets.
  5. List of Owner, Owner's Representative, Architect, Architect's Consultants, Contractor's project manager, superintendent, assistant superintendent, subcontractors, building inspector, police, ambulance and fire departments; include telephone numbers and fax numbers.
- F. Accommodation and Cooperation with the Owner: The Contractor shall cooperate with the Owner to the greatest extent possible. Disruptions and inconveniences to the activities of existing facilities to remain in operation during construction shall be minimized, and shall be subject to the prior approval of the Owner. The Contractor's cooperative efforts shall include,

but shall not necessarily be limited to:

1. Maintaining fire and all other safety standards acceptable to governing authorities.
2. Protecting existing building construction, landscaping, site utilities, site improvements and features, and all other improvements within and about the project area. See Division 2 for more information.
3. Obtaining abutters' written authorization to conduct construction related activities on their properties, if required. [NOTE: The Contractor shall obtain permits and approvals required to temporarily alter or obstruct sidewalks and street(s) if required.]
4. Storing on-site materials at locations acceptable to the Owner and governing authorities.
5. Controlling construction staging, parking, and traffic and limiting it to areas acceptable to the Owner and governing authorities.
6. Providing access for and cooperating with other contractors to be employed by the Owner.
7. Providing access for and cooperating with equipment and furnishing suppliers/installers (including the Owner's own forces) to be employed by the Owner.
8. Accommodating existing occupants and other ongoing activities within and about the Project. Such accommodations shall include, but shall not necessarily be limited to:
  - a. Maintaining safe ingress and egress acceptable to the Owner and governing authorities.
  - b. Maintaining adequate heating, air conditioning, and ventilation.
  - c. Maintaining fire suppression system.
  - d. Maintaining electrical power, fire alarm, and detection systems, sound systems, clock systems, intrusion detection systems, television, computer, and telephone services.
  - e. Maintaining special systems and services such as emergency electrical power and communication systems.
  - f. Maintaining a watertight roof and exterior wall assembly.
  - g. Providing adequate dirt, dust, fume, vapor, and noise control. NOTE: The Contractor shall take special precautions to prevent the introduction of construction related dust, fumes, vapors, etc. from entering into HVAC system ducts, return air grilles, fresh air intakes, etc. )
    - 1) See Section 01 50 00 - Temporary Facilities, for additional information.
  - h. Providing temporary fire and smoke partitions acceptable to governing authorities.
  - i. Providing adequate building security in areas under the Contractor's control.
  - j. Moving and relocating existing loose furniture, equipment and supplies as required to generally accommodate the Contractor will be the responsibility of the Owner, except as otherwise indicated on the Contract Documents. The Contractor shall provide the Owner a two week written notice of such need prior.
  - k. Scheduling work within the existing facility at times acceptable to the Owner and least disruptive to ongoing activities. Existing facilities shall remain in operation during the execution of the Work of this Contract. The Contractor shall schedule, phase, and coordinate the Work as required to maintain the safe and functional use of such facilities.

G. Phasing and Work Scheduling

Prior to completing and distributing the Construction Schedule or proceeding with the Work, the Contractor shall meet with the Owner, accurately assess the Owner's requirements relative to the use of existing facilities, and schedule the Work accordingly.

1. The following shall serve as a general description of the Work Phasing Plan, developed by the Owner and Architect related to the Work of this Contract. It has been developed to accommodate Owner needs for on-going occupancy of the facility. It shall be understood that this initial Phasing Plan is subject to change made by the Owner or initiated by the Contractor and agreed to by the Owner. The providing of this plan shall not in any way limit or diminish the Contractor's responsibility for the proper scheduling and coordination of the Work.



- a. Work Phasing Plan: The General Contractor shall submit to all parties the approved Work Phasing Plan prior to the start of work. The General Contractor shall continually monitor and update the Phasing Plan as appropriate. In addition to the overall plan the General Contractor shall provide a detailed two week look ahead schedule - biweekly throughout the work of the project.
  - b. All subcontractors shall coordinate with the Contractor to determine all phasing and sequencing requirements and to schedule the Work. Work shall be executed in such a manner that shall cause minimal or no disruptions of the Owner's activities and the activities of other trades.
  - c. Coordinate project phasing to limit temporary enclosure of window openings scheduled for removal. Upon the demolition of individual existing window units the Contractor shall prepare openings to receive new window units, including but not limited to associated blocking and flashing of rough openings. New permanent windows shall be installed immediately prior to the conclusion of the same work day. Unforeseen circumstances leading to and/or openings to be concealed by curtain wall systems requiring additional installation time, such openings shall be sealed weathertight. Grade level openings and openings with direct access into the Police Department bounds shall, in addition, receive a minimum 1/2" plywood sheathing for security measures. The Contractor shall be responsible for protection of all openings during the completion of other scope of work required.
  - d. Coordinate project phasing of scope of work related to all entry/exit entrances to maintain required life safety provisions and accommodating to ongoing Owner operations. In the event such scope of work requires the temporary closure of exit(s) coordinate life safety measures and/or alternative means of address required in agreement with the Authority Having Jurisdiction and the Owner.
  - e. Coordinate the Work Phasing Plan to include temporary enclosures, scheduling of and/or other measures determined by the Contractor as necessary to ensure that the interior environment remains weathertight upon demolition of exterior fenestration assembly. All means, methods, procedures, sequences and techniques required are the sole responsibility of the Contractor
  - f. Coordinate all shut-downs, service disruptions, demolition, removals, temporary connectors, service change-overs, etc., required to avoid Owner disruption and/or inconvenience.
  - g. Coordinate all deliveries, installation, etc., as required to avoid Owner disruption and/or inconvenience.
  - h. Temporary ductwork, piping, wiring, controls, and equipment measures for essential systems such as air conditioning, ventilation, hydronic heating, domestic hot and cold water, storm drainage, sanitary sewer, controls, lighting, power, emergency systems, clocks, security, fire protection, etc. shall be provided to:
    - 1) Keep existing systems functional,
    - 2) Maintain services between existing components that must be redirected around construction areas,
    - 3) Alter, redirect, or make safe,
    - 4) Temporarily relocate equipment to facilitate phasing.
  - i. Partial and/or phased occupancy of the facility shall require systems start-ups, tests, balancing, and other similar activities to occur at the completion of each portion of the Project, instead of exclusively at the completion of the entire Project. If system adjustments cannot be properly done until completion of the entire system, interim or temporary adjustments shall be provided for proper system operation and occupant comfort in occupied areas.
  - j. See Section 01 78 10 - Warranties for requirements regarding extended warranties for equipment serving phased occupancy.
- H. Safety: The Contractor shall assume full responsibility for all means, methods, procedures, sequences and techniques of construction employed and shall take all measures required to ensure the safety of construction workers, as well as the safety of the general public. The

Contractor shall take into full consideration and assure himself that all necessary barricades, fencing, and shoring are provided and that they comply with applicable regulations and standards of good practice. The public shall be guarded from all construction hazards and/or attractive nuisances. The construction site is a part of existing occupied buildings and nearby major public thoroughfares. Therefore, site safety is of the utmost importance. The Contractor shall pay all costs necessary for temporary partitioning, barricading, fencing, shoring, walks, ramps, enclosures, flashing lights, warning signs, security and safety devices required for the maintenance of a clean and safe construction site.

1. Owner's Safety Policies: Prior to the commencement of construction, the Contractor shall thoroughly review the Owner's facility and occupant safety policies and procedures and shall inform all construction workers of their related responsibilities. Should the Contractor take exception to any of the Owner's policies and procedures, he shall so notify the Owner and Architect, in writing, prior to proceeding with the Work. The failure to provide such notification shall be construed as full acceptance of the Owner's policies and procedures.
2. MSDS Sheets: The Contractor shall furnish copies of Material Safety Data Sheets to the Owner for all materials classified as hazardous or poisonous. MSDS for all materials shall be maintained with the Contractor in a file on-site.
3. The Contractor shall cooperate with and maintain a designated point of contact liaison with the Portsmouth Police Department, Portsmouth Fire Department and the Portsmouth Department of Public Works and he/she shall abide by safety or security related requests from any of these authorities.
- I. Indoor Air Quality Management:
  1. The Contractor and his various subcontractors as he may direct shall implement procedures throughout construction in an effort to improve indoor air quality during the Owner's occupancy. See Section 01 57 21- Indoor Air Quality Controls.
  2. The maintenance of a clean, dust-free environment in areas of the facility that remain operational or otherwise accessible to non-construction personnel shall be the shared responsibility of all construction personnel.
  3. Control of dust, vapors, odors, and the spread of fire shall be considered of paramount importance. Unless otherwise specifically required by the Owner, the means and methods of achieving such control shall remain the exclusive responsibility of the Contractor, and not the Owner or Architect. However, the following may be considered:
    - a. Fire-resistant plastic dust barriers. (Including above suspended ceilings. Provide ante rooms and gasketed doors where appropriate.)
    - b. Construction of non-combustible partitions and enclosures.
    - c. Negative pressure containment.
    - d. Duct tape and sealant.
    - e. Walk-off mats (adhesive treated).
    - f. Vacuuming (with HEPA filtered vacuum).
    - g. Closure of air intake vents (verify need for service prior to interruption).
  4. The Contractor and his various subcontractors as he may direct shall implement the following procedures in an effort to improve indoor air quality during the Owner's occupancy:
    - a. All adhesives (for construction, floor and wall coverings, etc.), paints, thinners, solvents, etc. shall, among other technical qualifications, be selected in consideration of minimizing their potential contribution to indoor air pollution.
    - b. Provide maximum all-outside-air ventilation during the installation of strong emitting materials. This shall be done for the purpose of reducing the contamination of other materials by absorption of solvents and other volatile components.
    - c. On projects where the Owner (or other user) occupies all or portions of the building during construction, the Contractor shall make every practical effort to minimize their exposure to fumes and dust from construction. Such efforts shall include items 1 through 3 above, as well as the construction of temporary air-tight barriers,

- maintaining negative air pressure in work areas, isolation of ventilation systems and all other appropriate means as determined by the Contractor.
- J. Environmental Regulations: The Contractor shall comply with all applicable environmental laws and regulations. Particular attention shall be paid to proper dust, fume and vapor control throughout the building and site.
  - K. Hazardous Substances: The Architect's Scope of Services and responsibilities exclude the investigation, discovery, detection, identification, presence, leakage, release, use, handling, disposal, encapsulation, abatement, treatment, or removal of, or exposure of a person or persons to hazardous materials, pollutants, contaminants, or disease transmitting organisms, pre-existing or otherwise deposited in any form at the project, indoors or outdoors, at any time before, during or after construction, including but not limited to volatile organic compounds, petroleum products, bacteria, molds, fungus, asbestos or asbestos products, lead, radon, electro-magnetic frequency radiation or other radiation. Should any such substances be encountered, the Owner and Architect shall be promptly notified, in writing.
  - L. Layout and Field Engineering: The Contractor shall be responsible for all layout of all Work, even if such layout is done by others. The Contractor shall employ a qualified field engineer or land surveyor to determine all lines and grades and to field verify existing job conditions and measurements indicated on the Drawings. The Contractor's responsibility includes but is not necessarily limited to levels, control points, base lines, on-site bench marks, reference points, siting of building and other improvements, locations of components, fixtures, equipment, finishes, site improvements, etc.
    - 1. The Contractor shall be responsible to submit a certificate signed by land surveyor registered in the State of New Hampshire, hired by the Contractor, certifying that the location of new building lines and location and elevation of improvements comply with the Contract Documents.
      - a. The Contractor shall submit in writing, to the Owner, the name of the survey firm used, address, and registration number of such person or persons.
    - 2. The Owner has generally identified on the existing conditions survey, existing topography, utilities, wetlands, control points, and property line corner stakes.
    - 3. The Contractor shall provide to the Architect written documentation to verify all layout. Include any deviations from the Contract Documents. Do not start any Work affected by such deviations until reviewed by the Architect.
      - a. Upon request by the Owner, the Contractor shall make available to the Owner survey instruments necessary to check the proposed vertical and horizontal alignments at no additional costs.
    - 4. The Contractor shall be responsible for costs of survey work including but not necessarily limited to establishing and protecting on-site benchmarks, replacement or relocation of bench marks, additional base lines or levels, reference points, location of site improvements, verification of existing building dimensions, layout and floor elevations. All discrepancies shall be reported to the Architect for clarification.
    - 5. The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction. Verify the location and invert elevation at point of connection of sanitary sewer, storm drainage, and water service piping, etc.
    - 6. The Contractor shall maintain a surveyor's log of control and other survey work. Record deviations from required lines, and level, and advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.
    - 7. The Contractor shall carefully examine all buildings, sites, and Contract Documents prior to submitting his Bid and satisfy himself as to the conditions under which he must operate to perform the Work. No additional compensation will be made to the Contractor for any error or negligence on his part, nor for discrepancies between actual conditions found at the buildings and sites and as indicated in the Contract Documents, unless such discrepancies are brought to the attention of the Architect by a Bidder or Sub-Bidder, in

writing, prior to the opening of Bids.

- M. Visual Recording: Prior to the start of construction, the Contractor shall make a color DVD recording along the entire work area. One complete recording shall be submitted to both the Owner prior to start of construction. The visual recording shall be identified as "Phase 1 Design for Portsmouth Senior Center / Former Doble U.S. Reserve Center". Recording shall be time and date stamped.
- N. Protection of Adjoining Property: The Contractor shall provide all shoring, fencing, and other work necessary to support, protect and keep unharmed all walls, footings, floors, roofs, walks, roadways and all other parts of any existing buildings, facilities, site improvements, land forms, trees and plant materials, etc. The Contractor shall hold the Owner and Architect harmless from any such damage due to any operations under this Contract. Any existing work or property damaged or disrupted as a result of this Contract shall be replaced or repaired to match original existing conditions at no additional cost to the Owner.
- O. Utilities: The Contractor shall send proper notices, make all necessary arrangements and perform all other services required for the removal or the care, protection and maintenance of all utilities, including, but not limited to, fire plugs (hydrants), electric, gas, water, sewer, alarm, television, telephone, computer, and telegraph poles and wires, and all other items of this character above or below the ground, on and around the building site, assuming all responsibility and paying all costs related thereto. Related services to any existing facilities shall not be disrupted without the prior approval of the Owner, and then only to the minimum extent required. The Contractor shall comply with the "Underground Utility Damage Prevention System" by notification to DIG SAFE SYSTEM of intent to excavate near or around any underground utility installations. The Contractor shall call DIG SAFE SYSTEM at least 72 working day hours in advance of starting any such excavation.
- P. Traffic Regulations and Parking: The Contractor shall properly regulate traffic at times when the Work interferes with the normal flow of traffic both on and off the site. Parking for workers and/or closure of drives and access lanes on the project shall be limited to areas designated of within schedules agreed to by the Owner and/or governing officials. Roadways and driveways outside the limits of the Contract shall be kept free of debris resulting from construction related traffic.
- Q. Roads and Access to the Site: Access to the site for workers and the delivery or removal of construction materials and/or equipment shall be made only from locations approved by governing authorities and acceptable to the Owner. Existing roads, lanes and other required fire access shall remain accessible to fire vehicles at all times. Hauling permits and route approvals shall be obtained from governing authorities as applicable.
- R. Security: The Contractor shall be responsible for the securing of new and existing structures against the entry of unauthorized persons at all times, including nights, holidays and days when the buildings may be unoccupied.
  - 1. When construction related personnel are the last to leave either the new or existing facilities, they shall verify that the entire building perimeter is properly secured.
  - 2. When non-construction related personnel are the last to leave either the new or existing facilities, the Contractor shall verify that all unoccupied areas are properly secured, and shall record the names and affiliations of those persons remaining in the facilities.
- S. Fire Protection: The Contractor shall maintain existing life safety systems in operation and use. Where new systems, replacement of system components and/or extensions of systems are required the new system shall be installed and ready for activation prior to disruption of service. Do not interrupt existing life safety system service without written approval by both the Owner and Authority Having Jurisdiction.
- T. Dewatering: The Contractor shall protect the Work, including but not limited to all excavations, trenches, buildings and materials from storm water, ground water, back-up or leakage of sewers, drains or other piping, and from water of any other origin and shall control, collect and dispose of any accumulation of such water.
  - 1. Dewatering operations shall include, but not be limited to:
    - a. Furnishing, operating, and maintaining all pumps, piping, drains, and other equipment, including spare units available for immediate use in the event of equipment breakdowns.

- b. Designing, engineering, constructing, maintaining and removing cofferdams, temporary underdrains, wellpoints and all other systems necessary for dewatering.
  - c. Disposing of all water in a safe and proper manner, acceptable to governing authorities.
- 2. The Contractor shall pay all costs related to dewatering. All damage resulting from dewatering operations, or the failure of the Contractor to maintain the Work in a suitable dry condition, shall be promptly repaired by the Contractor at no additional cost to the Owner.
- U. Snow Removal: The Contractor shall remove all snow or ice which might result in damage or delay to the Work.
- V. Vandalism: The Contractor shall take all reasonable precautions necessary to prevent loss or damage caused by vandalism, theft, burglary, pilferage, or unexplained disappearance of property of the Owner, whether or not forming part of the Work, located within those areas of the Project to which the Contractor has access.
- W. Existing Materials and Equipment: See Section 01 60 00 - Product Requirements.
- X. Shipping and Storage of Materials: See Section 01 60 00 - Product Requirements.
- Y. Owner Furnished Equipment: See Section 01 60 00 - Product Requirements.
- Z. Watertight Structure: The Contract Documents are not intended to depict each and every condition or detail of construction. As the knowledgeable party in the field, the Contractor is in the best position to verify that all construction is completed in a manner that will provide a watertight structure during construction (i.e. as needed to keep all interior construction dry both during and following its installation) and upon completion of construction. The Contractor shall be solely responsible for ensuring the watertight integrity of the structure.
- AA. Guarantee: The Contractor shall guarantee the entire Work to be free from defective or improper work or materials and shall make good any damage due to such work or materials for a term of one year from the date of the satisfactory completion and acceptance of the Work. See Section 01 78 10 - Warranties.

### 1.3 MEASUREMENT AND PAYMENT

- A. Schedule of Values: Submit a preliminary sample of the Schedule of Values for review and comment regarding format and content to the Architect at the earliest feasible date, but in no case later than fourteen (14) days prior to submittal of the first Application for Payment. The Schedule of Values shall clearly identify the cost of the Work by trade, plus all General Conditions, Allowances, and accepted Alternates.
  - 1. Separate Schedules of Values shall be prepared for each phase of the Work.
  - 2. The format and general content of such schedule shall be acceptable to the Owner and Architect.
    - a. Round amount off to the nearest whole dollar; the total shall equal the Contract Sum.
    - b. No later than seven (7) days prior to submittal of the first Application for Payment, the Contractor shall submit to the Architect and Owner, the fully completed Schedule of Values.
- B. Payment Requisition: The Contractor shall submit to the Architect three original copies of "Application for Payment", AIA Forms G702 and G703, an itemized statement showing the original Contract Amount, the value of the Work to date, the amount previously approved, the amount presently requested and the balance remaining. Each copy shall be fully executed and properly signed and sealed.
  - 1. Application for Payment entries shall match the Schedule of Values. Include amounts of Change Orders issued prior to the last day of the construction period covered by the application.
  - 2. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.
  - 3. Progress payment dates shall be as established elsewhere in the Agreement. The Contractor shall submit a draft of the Application for Payment to the Architect sufficiently in advance of but in no case less than two weeks prior the due date to the Architect to allow for preliminary review and adjustments. The Contractor at his/her discretion may opt within the draft Payment Requisition to project the two week preliminary review period. At the

- time of the due date the Architect shall review the value of work completed to be in general conformance with the value of the Payment Requisition.
4. The Contractor shall clearly differentiate between items stored on-site and items stored off-site. For off-site stored materials, provide invoices, list of materials, insurance certificate, right of entry, transfer of title, and other documents as may be required by the Architect and Owner.
  5. Provide invoices, vouchers, time sheets, and other documents as may be required by the Architect to verify labor and materials costs.
  6. Each Application for Payment shall be accompanied by a transmittal listing all attachments.
  7. Initial Application for Payment: The following administrative actions and submittals shall precede or coincide with the submittal of the first Application for Payment:
    - a. List of subcontractors, principal suppliers, and fabricators.
    - b. Schedule of Values.
    - c. Contractor's Construction Schedule (preliminary, if not final).
    - d. Contractor's Submittal Schedule (preliminary, if not final).
    - e. List of Contractor's staff assignments.
    - f. Copies of building permits, authorizations, and licenses from governing authorities.
    - g. Certificates of insurance.
    - h. Data needed to acquire Owner's insurance.
    - i. Initial Progress Report.
    - j. Performance and Payment Bonds, if applicable.
  8. Application for Payment at Substantial Completion: Submit an Application for Payment following issuance of the Certificate of Substantial Completion. The application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work. See AIA 201 General Conditions of the Contract. The following administrative actions and submittals shall precede or coincide with the submittal of this Application for Payment:
    - a. Occupancy permits, as applicable.
    - b. Warranties and maintenance agreements.
    - c. Testing / adjusting / balancing reports.
    - d. Maintenance instructions.
    - e. Meter readings, as applicable.
    - f. Start-up performance reports.
    - g. Change-over information related to Owner's occupancy, use operation and maintenance.
    - h. Final cleaning.
    - i. Application for reduction of retainage, and consent of surety.
    - j. Advice on shifting insurance coverage.
    - k. List of incomplete Work, recognized as exception to the Architect's Certificate of Substantial Completion, if any.
  9. Final Application for Payment: This application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work. See Article regarding Final Payment of the Agreement and AIA 201 General Conditions of the Contract. The following administrative actions and submittals shall precede or coincide with the submittal of the final Application for Payment:
    - a. All items required by Article 9 "Payments & Completion" of AIA A201.
    - b. Completion of Project close-out requirements.

- c. Completion of items specified for completion after Substantial Completion.
  - d. Assurance that unsettled claims will be settled.
  - e. Transmittal of required Project construction records, including Record Drawings to the Owner.
  - f. Proof that taxes, fees and similar obligations have been paid.
  - g. Removal of temporary facilities and services.
  - h. Removal of surplus materials, rubbish, and similar elements.
- C. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics lien for every entity who is lawfully entitled to file a lien arising out the Contract and related to the Work covered by the Payment. See AIA A201 General Conditions of the Contract.
  - 1. The Contractor shall promptly execute a partial waiver of mechanics lien for the period of construction covered by each application. Executed waivers shall be submitted to the Architect with the submittal of the next Application for Payment by the Contractor. With each Application for Payment, submit partial waiver of mechanics liens from subcontractors, or sub-subcontractors and suppliers for the construction period covered by the previous application.
  - 2. When an application shows completion of an item, submit final or full waivers when retainage is released.
  - 3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
  - 4. Submit the final Application for Payment with or preceded by final waivers from every entity involved with the performance of the Work covered by the application who could lawfully be entitled to a lien. The total amount of each entity's final waiver of lien shall equal the Contract Sum for that entity including all additions and reductions thereto.
  - 5. Submit waiver of liens on the following forms, and executed in a manner, acceptable to the Owner:
    - a. Partial waiver of liens: Form provided by the Contractor and acceptable to the Architect and Owner.
    - b. Final waiver of liens: AIA G706A Contractor's Affidavit of Payment of Release of Liens or another form acceptable to the Architect and Owner.
- D. Schedule Update: Along with each payment requisition, the Contractor shall submit construction photographs and a report on the status of the next month's construction schedule. Each such monthly report shall update the progress of the Work and shall identify:
  - 1. Areas of the building and site expected to be worked on during the next month.
    - a. The monthly schedule indicated herein is in addition to the biweekly outlook schedule required by the Contractor to be provided to the Architect and Owner at the typical Job Meetings.
  - 2. Special conditions or circumstances that may affect the safe use of the building or site.

#### **1.4 MODIFICATION PROCEDURES**

- A. Minor Changes to the Work: Supplemental Instructions, authorizing minor changes in the Work, not involving an adjustment to the Contract Sum or Contract Time, may be issued by the Architect.
- B. Architect / Owner Initiated Change Order Proposal Requests: The Architect shall issue Proposal Requests that describe proposed changes in the Work that may require adjustment to the Contract Sum and/or Contract Time. The Architect will provide supplemental sketches or revised Drawings and Specifications as necessary.
  - 1. Proposal requests are for information only. Do not consider them an instruction either to stop work in progress, or to execute the proposed change.
  - 2. Unless otherwise indicated in the proposal request, within ten working days of receipt of the proposal request, the Contractor shall submit to the Architect and Owner for review, an estimate of cost necessary to execute the proposed change. Include an itemization of quantities, unit costs, etc. Include all related charges and a statement indicating the effect the proposed change will have on the Contract Time.

- C. Contractor Initiated Change Order Proposal Requests: The Contractor may propose changes when latent or other unforeseen conditions require modifications to the Contract, by submitting a request for a change to the Architect.
  - 1. Provide a complete description of the proposed change. Indicate the reason for the change and the effect of the change on the Work, the Contract Sum and the Contract Time. Include an itemization of quantities, unit costs, etc. and include all related charges. Comply with requirements for "Substitutions".
- D. Allowances: See Section 01 21 00 - Allowances. For allowance cost adjustment, base Change Order Proposal on the difference between the actual purchase amount and the allowance, multiplied by the measurement for work-in-place. Submit substantiation of all changes in Work claimed in the Change Orders. The Owner reserves the right to establish the actual quantity of work-in-place by independent quantity survey, measure, or count.
  - 1. No change to the Contractor's indirect expense is permitted for selection of higher or lower priced materials or systems of the same scope and nature as originally indicated. A change in the Contractor's indirect expense will only be allowed when it is clearly demonstrated that either the nature or scope of the Work was changed from that which could be foreseen from the description of the allowance and other information in the Contract Documents.
- E. Construction Change Directive: Construction Change Directives, containing descriptions of changes in the Work and designating methods to be followed to determine changes in the Contract Sum and/or Contract Time may be issued by the Architect.
  - 1. Maintain detailed records of time and materials related to the Work required by the Construction Change Directive. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.
- F. Change Order Procedures: Upon the Owner's approval of a Change Order Proposal Request, the Architect will issue a Change Order for signatures of the Contractor, PW Director, City Finance and City Manager, (5) copies to be provided.

## 1.5 SUBSTITUTIONS

- A. Substitutions are changes, modifications or deviations in those products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after the receipt of Bids. Substitutions for the convenience of the Contract or subcontractors, or materials suppliers will only be considered if submitted prior to the receipt of Bids, in strict conformance with the Instructions to Sub-bidders.. The following shall not be considered substitutions:
  - 1. Changes, modifications, or deviations requested by Bidders during the bidding period and accepted prior to the receipt of Bids shall be considered as included in the Contract Documents and are not subject to the requirements of this Section.
  - 2. Revisions to Contract Documents requested by the Owner or Architect.
  - 3. Specified options of products or materials included in the Contract Documents.
  - 4. The Contractor's compliance with governing regulations and orders issued by governing authorities, subject to the Architect's prior written notice and approval.
- B. Substitution Requests: See Section 01 60 00 - Product Requirements, for substitution request procedures.

## 1.6 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for requirements regarding submission of:
  - 1. Outline Construction Schedule.
  - 2. Comprehensive Construction Schedule.
  - 3. Schedule of Materials.
  - 4. Schedule of Submittals.
  - 5. Shop Drawings, Product Data and Samples.
  - 6. Mock-ups and Sample Field Installations.



## 7. Requests for Substitution

### 1.7 ELECTRONIC MEDIA

- A. Electronic Media: See Section 01 00 30 - Electronic Media, for information regarding obtaining the Contract Documents electronically and their limited use for purposes of project coordination, Contractor's use in the preparation of submittals, and Contractor's use in the preparation of Record Drawings.

### 1.8 QUALITY CONTROL

- A. General: The Owner shall employ an independent testing agency for the purpose of testing and inspecting portions of the Work in progress. The Contractor and his various subcontractors shall be responsible for specific testing and inspections as identified in individual specification sections. See Section 01 40 00 - Quality Requirements.

### 1.9 TEMPORARY FACILITIES

- A. See Section 01 50 00 - Temporary Facilities and Controls, for information regarding:
  - 1. Field offices and storage sheds.
  - 2. Project signs.
  - 3. Temporary utilities.
  - 4. Temporary stairs, hoists, and lifts.
  - 5. Temporary enclosures and heat.
  - 6. Sanitary facilities.
  - 7. Temporary protective covering of finished work.
  - 8. Temporary protection of existing facilities.
  - 9. Temporary fencing.
  - 10. Temporary fire protection.
  - 11. Temporary drainage and storm water control.
  - 12. Temporary parking and roads.
  - 13. Clean-up and waste removal.

### 1.10 PROJECT MEETINGS

- A. The Contractor shall schedule the following project meetings including but not limited to:
  - 1. Pre-Construction Meeting.
  - 2. Pre-Installation Meetings.
  - 3. Coordination Meetings.
  - 4. Job Meetings.
  - 5. Project Close-out Meeting.
  - 6. Other meetings as necessary.
- B. Pre-Construction Meeting: The Contractor shall conduct an initial organization meeting at the Project site or other convenient location after the Notice to Proceed and prior to commencement of construction activities. The Owner, Architect, Owner's Representative, Contractor, his Superintendent, major subcontractors, and other concerned parties shall each be represented at the meeting by persons familiar with and authorized to conclude matters related to the Work. The Contractor shall record the minutes of this meeting. The minutes shall be distributed promptly to all participants.
  - 1. Agenda items shall include, but not be limited to:
    - a. Notice to Proceed
    - b. Designation of personnel representing the parties and their responsibilities.
      - 1) Emergency Contacts
    - c. Contract Documents: on-site documents, discrepancies or omissions, interpretations and clarifications.
    - d. Subcontractors
    - e. Schedule of Values
    - f. Insurance requirements.
    - g. Application for Payment: progress payments, Substantial Completion, off-site stored

- materials.
  - h. Project meetings.
  - i. Layout.
  - j. Scheduling: Construction schedule, working hours, overtime, holidays.
  - k. Permits and regulations
  - l. Testing and inspections.
  - m. Submittals: schedule, process, shop drawings, samples, record documents.
  - n. Substitutions.
  - o. Changes.
  - p. Job responsibilities: Superintendent, Owner's Representative.
  - q. Temporary facilities: parking, staging areas, site security, water, power, clean-up
  - r. Job safety.
- C. Pre-Installation Meetings: The Contractor shall conduct pre-installation meetings before each major construction activity that requires coordination is begun. Attendees may include the Contractor, Superintendent, Owner's Representative, Architect, Installers, Manufacturer's representatives, and fabricators. Refer to individual Specification Sections for required pre-installation meetings. Review progress of other construction activities and preparation for the particular activity under consideration.
- D. Coordination Meetings: The Contractor shall conduct coordination meetings at regularly scheduled times convenient to all parties. All major subcontractors shall be represented and other trades or subcontractors as required for coordination, planning and scheduling construction activities. The Contractor shall bring any significant issues to the next Job Meeting.
- E. Job Meetings: The Contractor shall conduct regular job meetings once every two weeks during the construction period, at such time as is mutually acceptable to the Owner, Architect and Contractor. All major subcontractors shall be represented at each meeting as needed. Other trades or subcontractors may be called to particular job meetings as the progress of the Work requires. The Contractor shall record the minutes of each meeting. The minutes shall be distributed promptly to all participants.
- 1. Agenda items shall include, but not be limited to:
    - a. Review construction progress since the last meeting.
    - b. Review work progress in relation to the Construction Schedule.
    - c. Review two week look ahead work schedule forecast.
    - d. Review "Old Business" and new items significant to the Work.
    - e. Review issues regarding construction activities and Owner's on-going occupancy.
    - f. Review work sequence, deliveries, hazards, quality standards, housekeeping, security, etc.
    - g. Review Change Orders, Proposal Requests, Requests for Information, Supplemental Instructions.
    - h. The Contractor will distribute updated Construction Schedule once per month.
- F. Project Close-out Meeting: See Section 01 78 00 - Project Close-out.

### **1.11 WARRANTIES**

- A. See Section 01 78 10 - Warranties, for requirements regarding submission of a bound set of warranties and certificates as required by the Contract Documents.

### **1.12 PROJECT CLOSE-OUT**

- A. See Section 01 78 00 - Project Close-out, for requirements regarding:
- 1. Substantial Completion procedures, including Project Close-out Meeting and Occupancy Permit.
  - 2. Architect's evaluation of the Work.
  - 3. Final Acceptance procedures.
  - 4. Project record documents submittal, including O&M manuals, warranties binder, record photographs, and record drawings.
  - 5. Spare parts and extra materials procedures.

6. Indoor Air Quality Management, building commissioning and systems testing.
7. Operating and maintenance instructional sessions.
8. Final cleaning.
9. Contractor's Certificate of No Hazardous Materials.
  - a. Testing agency final report.
- B. Occupation by the Owner: The Owner shall have the right to take possession of and use any completed or partially completed portions of the Work, notwithstanding the fact that the time for completing the entire Work or such portions thereof may not have expired; but such possession and use shall not be an acceptance of the Work.

#### **1.13 TIME FOR COMPLETION AND LIQUIDATED DAMAGES**

- A. Time is of the essence of the Contract, and the Work to be performed under the Contract shall be commenced on or before **TBD**, and shall be Substantially Complete and in receipt of an Occupancy Permit on or before **TBD**.
- B. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for completion of the Work described herein is reasonable for the completion of same, taking into consideration the climatic and industrial conditions prevailing in this locality.
- C. From the compensation otherwise to be paid, the Owner may retain the sum of Three Hundred Dollars (\$ 300) per calendar day, after the expiration of the above date, that the Work under the Contract remains incomplete or unacceptable to the Architect or Owner. Such sum shall be agreed upon as the proper measure of liquidated damages which the Owner will sustain per diem by failure of the Contractor to complete the Work within the agreed upon number of calendar days, and this sum shall not be construed as in any sense a penalty.
  1. (NOTE: Should the proposed construction start date be postponed, through no fault of the Contractor, the date of Substantial Completion shall be equitably adjusted.)

**END OF SECTION**

**SECTION 01 00 30  
ELECTRONIC MEDIA**

**PART 1 – GENERAL**

**1.1 DESCRIPTION**

- A. The provisions of this Section apply to each and every contract and contractor or other person or persons supplying labor, material, equipment and/or services entering into this Project and/or on the premises directly or indirectly.
- B. Following the receipt of a written request by the Contractor, signed Electronic Data Transfer and Non-Disclosure Agreement, and if applicable, payment in full from the Contractor, the Architect will make available an electronic data version of the Project, for the limited purposes described in this Agreement. It shall be the Contractor's responsibility to make electronic files available to subcontractors in accordance with the Electronic Data Transfer and Non-Disclosure Agreement.

**ELECTRONIC DATA TRANSFER AND NON-DISCLOSURE AGREEMENT**

The Agreement is entered into and agreed by, between and among AECm, and TO BE DETERMINED (Recipient) and is made in reference to the PHASE 1 DESIGN FOR PORTSMOUTH SENIOR CENTER, 1

Junkins Avenue, Portsmouth, New Hampshire Project. It is understood and agreed that it may become desirable for A E C m to make certain Instruments of Service in electronic machine readable format, hereinafter referred to as "Electronic Data" available to other parties related to the Project. It is also understood that such information is proprietary to AECM and that AECM intends to limit its distribution and use. It is the intent of the Agreement to govern all circumstances under which Electronic Data is made available by AECM.

In consideration of the request of TO BE DETERMINED (Recipient) to AECM to deliver to Recipient or otherwise enable the Recipient to access certain Electronic Data for use on the Project, the parties mutually agree as follows:

1. Electronic Data includes but is not limited to, computer-aided design files including native file formats (DWG), Building Information Models (BIM), files produced by word processing, spread sheet, scheduling, data base and other software programs. Computer-Aided-Design files shall be provided as Autocad .dwg files. Building Information Models shall be provided as Revit .rvt files.
2. The means by which the Electronic Data is transferred may include, but are not limited to, electronic mail, File Transfer Protocol sites and CD-Rom, transmitted between the parties in this Agreement. Recipient acknowledges that Electronic Data transferred in any manner or translated from the system and format used by AECM to an alternate system or format is subject to errors that may affect the accuracy and reliability of the data and that the data may be altered, whether inadvertently or otherwise. Accordingly, AECM makes no warranty, express or implied, as to the correctness, accuracy, and/or completeness of the information transferred. Although AECM may issue information throughout the development of the Project, AECM does not represent that the information provided includes all revisions to-date, nor shall AECM assume any responsibility for providing updated information as the Project proceeds.
3. AECM reserves the right to retain hard copy originals in addition to electronic copies of the Electronic Data transferred, which originals shall be referred to and shall govern in the event of any inconsistency with the transferred data. Should the recipient discover errors or conflicts in any transferred files, he shall promptly notify AECM.

4. As consideration to AECM for the transfer of the Electronic Data, Recipient agrees that the use of Electronic Data shall be entirely at his/her own risk, and that AECM shall not be liable for, and Recipient hereby waives all claims and agrees to indemnify and hold AECM harmless from all liabilities, claims, losses, damages or expenses (including attorneys' fees) arising out of, or connected with: (1) the transfer of Electronic Data by any means; or

(2) the use, modification or misuse of the Electronic Data by parties other than AECM; or (3) the limited life expectancy and decline of accuracy or readability of the Electronic Data due to storage; or (4) translation and data errors; or (5) any use of the Electronic Data by any third parties receiving the data from other parties to this Agreement; or (6) the incompatibility of software or hardware used by AECM and the other parties to this Agreement.

**5. The Electronic Data provided by AECM under the terms of this Agreement is the proprietary information of AECM, containing designs, details, model elements and other information developed by AECM. AECM is willing to supply such information only if the Recipient enters into this Non-Disclosure Agreement and agrees to strictly enforce its terms and conditions. All Electronic Data is to be treated as confidential and is not to be disclosed to or shared with any third parties, not expressly allowed herein, without AECM's express, written consent.**

6. Recipient agrees to maintain and protect any and all proprietary information of AECM and to exercise great care in the preservation of its confidentiality. The Recipient will disclose the proprietary information only to its own employees, and then only to the extent required for the design and construction of this Project. The Recipient shall be responsible for any unauthorized use or disclosure of AECM's proprietary information by anyone to whom it may disclose such information.

7. The Recipient agrees that any and all Electronic Data shall remain the property of AECM. Neither the execution of this Agreement, nor the transfer of Electronic Data shall constitute a conveyance or transfer to the Recipient of any right, interest, or license in the proprietary materials. The Recipient shall not reproduce any proprietary information without the express written authorization of AECM.

8. Electronic Data are provided as a convenience to the Recipient for informational purposes only in connection with the Recipient's performance of its responsibilities and obligations relating to the Project. The Electronic Data do not replace or supplement the paper copies of the Drawings and Specifications which are and remain, the Contract Documents for the Project.

**9. Electronic Data shall only be used for purposes allowable by this Agreement. It is understood and agreed that, without the separate express written permission of AECM to do so, the Electronic Data are not to be used for any purpose whatsoever, by anyone (any contractor or any of its subcontractors of any tier or any materials supplier or vendor) other than the Recipient. It shall be the responsibility of the Recipient to notify AECM of any and all third parties with whom the Recipient wishes to share AECM's Electronic Data, to identify the intended uses of the information, and to obtain AECM's prior written authorization to share AECM's information.**

10. All transmittal of Electronic Data whether by CD-Rom, e-mail, Internet or any other methods shall require that the file name, size, date and time be recorded along with the date and time of transmission (if by electronic means) and the identity of the sender and recipient.

11. The Recipient further agrees to indemnify and save harmless AECM and its sub-consultant and each of their partners, officers, shareholders, directors and employees from any and all claims, judgments, suits, liabilities, damages, costs or expenses (including reasonable defense and attorneys' fees) arising as the result of either: 1) Recipient's failure to comply with any of the requirements of the Electronic Data Transfer Agreement; or 2) a defect, error or omission in the Electronic Data or the information contained therein, which defect error or omission was not contained in the Contact Documents as

defined in paragraph 3 or where the use of such Contact Documents would have prevented the claim, judgment, suit, liability, damage, cost or expense.

12. This agreement shall be interpreted under the laws of the State of New Hampshire. The Recipient hereby agrees that the breach of this Agreement by the Recipient will cause AECM considerable harm, and AECM shall be entitled to recover damages, as well as all expenses and costs incurred by AECM arising out of or related to such breach, including, without limitation, reasonable attorney's fees and costs.

13. In general, the protocols for the distribution of Electronic Data shall be as follows:

- a. AECM may make certain Electronic Data available to TO BE DETERMINED (Recipient - MUST be Owner, Construction Manager or General Contractor) free of charge, providing that:
  - 1) Such files can be issued in the format currently used by AECM, without modification.
  - 2) The Recipient delivers to AECM a fully executed copy of this Agreement and, among other requirements, agrees not to share AECM's Electronic Data with any third parties without AECM's prior written authorization.
- b. In the event the Recipient wishes to share AECM's Electronic Data with a third party:
  - 1) The Recipient shall first forward a complete list of all such third parties to AECM for AECM's prior written authorization. The list shall include all third party names, addresses, telephone numbers, and email addresses.
  - 2) Each individual third party shall then deliver, through the Recipient, a fully executed copy of this Agreement.
- c. In the event that it is necessary for AECM to convert files from its currently used format of REVIT to an alternative format, AECM shall be compensated for such conversion at the rate of \$75.00 per file, payable in advance.

The parties have executed this Agreement as of the dates stated below:

RECIPIENT

Company: \_\_\_\_\_  
 By: \_\_\_\_\_  
 Title: \_\_\_\_\_  
 Date: \_\_\_\_\_

AECM

Title: \_\_\_\_\_  
 Date: \_\_\_\_\_

**END OF SECTION**

**SECTION 01 21 00  
ALLOWANCES****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Cash Lump Sum and Unit Cost allowances.
- B. Inspecting and testing allowances.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 00 00 - General Requirements: Additional payment and modification procedures.

**1.03 CASH ALLOWANCES**

- A. Types of allowances required include Lump Sum allowances and Unit Cost allowances.
- B. All Allowances under this Section shall be included in the Base Bid and shall be carried by the Contractor, unless specifically indicated to be carried by a subcontractor.
- C. The Contract shall cause the work covered by these Allowances to be performed for such amounts and by such persons as the Owner may direct, but he will not be required to employ persons against whom he makes a reasonable objection.
- D. Costs Included in Cash Allowances: Cost of product to the Contractor or subcontractor, less applicable trade discounts, and other costs, if any, specifically included in the description of the Allowance.
- E. Costs Not Included in Cash Allowances: Product delivery to site and handling at the site, including unloading, uncrating, and storage; protection of products from elements and from damage; and labor for installation and finishing, unless specifically included in the description of the Allowance.
- F. Refer to related Drawings and Specifications for additional information regarding Work to be included as a part of Allowances.
- G. All allowance items shall be furnished and installed by the General Contractor.
- H. Allowance items include all ancillary work and appurtenances required to provide a complete and fully operable system.
- I. Architect Responsibilities:
  - 1. Consult with Contractor for consideration and selection of products, suppliers, and installers.
  - 2. Select products in consultation with Owner and transmit decision to Contractor.
  - 3. Prepare Change Order.
- J. Contractor Responsibilities:
  - 1. At the earliest practical date after award of the Contract, advise the Architect of the date when selection and purchase of each product or system described by an Allowance must be completed to avoid delaying the Work.
  - 2. Assist Architect in selection of products . Where services, products and/or systems are selected by the Owner, purchase such items from the designated supplier.
  - 3. Obtain proposals from suppliers and installers for use in making final selections and offer recommendations.
  - 4. On notification of which products have been selected, execute purchase agreement with designated supplier and installer.
  - 5. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
  - 6. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.
  - 7. Submit invoices or delivery slips to show quantities of materials delivered to the site for use in fulfilling each allowance.
  - 8. Cost monitoring:
    - a. Monitor progress of Allowance costs and expenditures and regularly report to the Architect and Owner.
    - b. Provide written advance notice to Architect and Owner if Allowance is likely to be

- exceeded.
- c. Obtain Owner's written authorization prior to incurring costs in excess of the stated Allowance.
- d. The Contractor shall assume responsibility for all costs in excess of the stated Allowance with failure to perform the above cost monitoring procedures.
- K. If the cost, when determined, is more than or less than the Allowance, the Contract Sum shall be adjusted accordingly by Change Order, which will include additional or reduced handling costs on the site, labor, installation costs, overhead, profit and other expenses resulting to the Contractor for any increase over or decrease from the original Allowance.
- L. All scheduled allowance items shall be submitted to the City of Portsmouth for review and approval prior to Contractor purchase.
- M. The Owner retains the right to delete allowance items from contract prior to submittal approval.

## **PART 2 – ALLOWANCES**

### **2.01 INSPECTING AND TESTING ALLOWANCE**

- A. Owner will engage a qualified testing agency to conduct periodic tests to confirm construction is in conformance with specified procedures and specifications. Test results shall be submitted to the Architect for review within 72 hours of completion of each test.

### **2.02 GRAPHICS**

- A. Allow the sum of \$ 12,000 for furnishing and installation of architectural graphics, signage and plaques (interior and exterior). This Allowance shall be in addition to the Work of Section 10 14 24: Interior Signage.

### **2.03 ELECTRONIC ENTRY CARD READER SYSTEMS**

- A. Allow the sum of \$ 8,000 for the purchase and installation of four (4) electronic card readers for the specified doorways.

### **2.04 GAS FIREPLACE**

- A. Allow the sum of \$ 6,000 for the purchase and installation of a Natural Gas Fireplace insert and ventilation.

### **2.05 AUDIO-VIDEO SYSTEMS**

- A. Allow the sum of \$ 20,000 for the purchase and installation of a motorized rollup projection screen, ceiling-mounted DLP video projector (4K) with multi-channel speaker system, and large format LCD televisions/monitors (multiple ceiling or wall mounted units).

### **2.06 EXTERIOR AMENITIES**

- A. Allow the sum of \$ 20,000 for the purchase and installation of patio furnishings (chairs, benches, tables, and planter units), statues, and carved stone monuments.

### **2.07 WALL COVERINGS**

- A. Allow the sum of \$ 3,000 for the purchase and installation of wall coverings including cork-board sheets, wallpaper, murals, and other fixed wall coverings.

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

**END OF SECTION**



**SECTION 01 23 00  
ALTERNATES****PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Description of Alternates.
- B. The Contractor shall provide all labor, materials, equipment, and services, etc., necessary for the proper and complete execution of accepted Alternates. Amount of Alternate prices to be added to or deducted from the Base Bid shall be stated on the Proposal Form and shall include cost of any and all modifications made necessary by Owner's acceptance of Alternates.
- C. Related Work Described Elsewhere:
  - 1. Materials and methods to be used in the Base Bid and in the Alternatives are generally described in the Contract Documents.
  - 2. Method for stating the proposed Contract Sum is described in the Proposal Form.
- D. NOTE: Alternates will be carefully considered in the Owner's selection of a Contractor.

**1.2 RELATED REQUIREMENTS**

- A. Document 01 21 00 - Instructions to Bidders: Instructions for preparation of pricing for Alternates.

**1.3 ACCEPTANCE OF ALTERNATES**

- A. If the Owner elects to proceed on the basis of one or more of the described Alternates, make all modifications to the Work required in order to furnish and install the selected Alternate or Alternates to the approval of the Architect and at no additional cost to the Owner, other than as proposed on the Proposal Form.
- B. Immediately after award of the Contract, or as soon thereafter as the Owner has made a decision on which, if any, Alternates will be selected, thoroughly and clearly advise all necessary personnel and suppliers as to the nature and extent of Alternates selected by the Owner. Use all means necessary to alert those personnel and suppliers involved as to all changes in the Work caused by the Owner's selection or rejection of Alternates.
- C. It shall be the responsibility of the Contractor to properly coordinate work related to Alternates with all other Work of this Contract in order to ensure that a complete and proper job is provided.
  - 1. Include as part of each Alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.
- D. Submit a Schedule of Values including adjustments to all Sections affected by accepted Alternates.
- E. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement. The Owner reserves the right to select as many or as few alternates as they deem fit, in any order or combination that they choose.
- F. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

**1.4 SCHEDULE OF ALTERNATES**

- A. Alternate No.1 (Concrete Slab Moisture Barrier System for Resilient Flooring)
  - 1. State the amount to be ADDED to the Base Bid to furnish and install the slab moisture barrier system and primer, if Owner's field testing indicates an issue with slab moisture vapor and alkalinity levels for flooring installations. See Section 12 48 13 – Entrance Floor Mats and Frames.

2. State the amount to be ADDED to the Base Bid to provide blast-trac slab surface preparation to remove surface slab contaminants and produce a bondable surface as required by the slab moisture barrier system.
  3. State the amount to be ADDED to the Base Bid to provide self-leveling cement-based underlayment. See Section 09 65 00 - Resilient Flooring.
- B. Alternate No. 2 (Repointing, Crack Repair and Replacement of Masonry)
1. Provide a square foot allowance for the repointing of existing masonry not otherwise identified in the Contract Documents to require pointing. All masonry repointing identified elsewhere in the Contract Documents shall be included in the Base Bid and shall not be paid for as a part of this Allowance. This Allowance shall only be used to pay the cost of repointing of masonry originally assumed not to require such repairs.
    - a. Brick Masonry (Modular units measuring 3-5/8" x 2-1/4" x 7-5/8"):  
\$ \_\_\_\_\_ SF
    - b. CMU Masonry (Modular units measuring 7-5/8" x 7-5/8" x 15-5/8"):  
\$ \_\_\_\_\_ SF
  2. Provide a linear foot allowance for epoxy repair of existing masonry/concrete cracks, fissures or similar irregularities not otherwise identified in the Contract Documents to require repair. All similar epoxy repairs identified elsewhere in the Contract Documents shall be included in the Base Bid and shall not be paid for as a part of this Allowance. This Allowance shall only be used to pay the cost of epoxy repair of masonry/concrete originally assumed not to require such repairs.
    - a. Brick Masonry: \$ \_\_\_\_\_ LF
    - b. CMU Masonry: \$ \_\_\_\_\_ LF
    - c. Concrete: \$ \_\_\_\_\_ LF
  3. Provide a square foot allowance for the removal and replacement of existing masonry units in kind not otherwise identified in the Contract Documents to require replacement. All masonry unit removal and replacement identified elsewhere in the Contract Documents shall be included in the Base Bid and shall not be paid for as a part of this Allowance. This Allowance shall only be used to pay the cost of removal of and replacement of masonry units originally assumed not to require such scope of work.
    - a. Brick Masonry (Modular units measuring 3-5/8" x 2-1/4" x 7-5/8"):  
\$ \_\_\_\_\_ SF
    - b. CMU Masonry (Modular units measuring 7-5/8" x 7-5/8" x 15-5/8"):  
\$ \_\_\_\_\_ SF
  4. Provide a square foot allowance for the parging and infill of bed joints and other block face irregularities at existing CMU infill masonry units scheduled to receive application of new weather barriers.
    - a. \$ \_\_\_\_\_ SF
- C. Alternate No. 3 (Existing CMU Substrate Wall and Steel Bar Joist Connection)
1. State the amount to be ADDED to the Base Bid to furnish and install repair and reinforcement requirements at existing CMU substrate walls as indicated per the Structural Drawings. See Structural Drawings (S-Series) for clarification.

**PART 2 PRODUCTS - NOT USED****PART 3 EXECUTION - NOT USED****END OF SECTION**

**SECTION 01 23 00  
ALTERNATES****PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Description of Alternates.
- B. The Contractor shall provide all labor, materials, equipment, and services, etc., necessary for the proper and complete execution of accepted Alternates. Amount of Alternate prices to be added to or deducted from the Base Bid shall be stated on the Proposal Form and shall include cost of any and all modifications made necessary by Owner's acceptance of Alternates.
- C. Related Work Described Elsewhere:
  - 1. Materials and methods to be used in the Base Bid and in the Alternatives are generally described in the Contract Documents.
  - 2. Method for stating the proposed Contract Sum is described in the Proposal Form.
- D. NOTE: Alternates will be carefully considered in the Owner's selection of a Contractor.

**1.2 RELATED REQUIREMENTS**

- A. Document 00 21 13 - Instructions to Bidders: Instructions for preparation of pricing for Alternates.

**1.3 ACCEPTANCE OF ALTERNATES**

- A. If the Owner elects to proceed on the basis of one or more of the described Alternates, make all modifications to the Work required in order to furnish and install the selected Alternate or Alternates to the approval of the Architect and at no additional cost to the Owner, other than as proposed on the Proposal Form.
- B. Immediately after award of the Contract, or as soon thereafter as the Owner has made a decision on which, if any, Alternates will be selected, thoroughly and clearly advise all necessary personnel and suppliers as to the nature and extent of Alternates selected by the Owner. Use all means necessary to alert those personnel and suppliers involved as to all changes in the Work caused by the Owner's selection or rejection of Alternates.
- C. It shall be the responsibility of the Contractor to properly coordinate work related to Alternates with all other Work of this Contract in order to ensure that a complete and proper job is provided.
  - 1. Include as part of each Alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.
- D. Submit a Schedule of Values including adjustments to all Sections affected by accepted Alternates.
- E. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement. The Owner reserves the right to select as many or as few alternates as they deem fit, in any order or combination that they choose.
- F. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

**1.4 SCHEDULE OF ALTERNATES**

- A. Alternate No.1 (Concrete Slab Moisture Barrier System for Resilient Flooring)
  - 1. State the amount to be ADDED to the Base Bid to furnish and install the slab moisture barrier system and primer, if Owner's field testing indicates an issue with slab moisture vapor and alkalinity levels for flooring installations. See Section 12 48 13 – Entrance Floor Mats and Frames.

2. State the amount to be ADDED to the Base Bid to provide blast-trac slab surface preparation to remove surface slab contaminants and produce a bondable surface as required by the slab moisture barrier system.
  3. State the amount to be ADDED to the Base Bid to provide self-leveling cement-based underlayment. See Section 09 65 00 - Resilient Flooring.
- B. Alternate No. 2 (Repointing, Crack Repair and Replacement of Masonry)
1. Provide a square foot allowance for the repointing of existing masonry not otherwise identified in the Contract Documents to require pointing. All masonry repointing identified elsewhere in the Contract Documents shall be included in the Base Bid and shall not be paid for as a part of this Allowance. This Allowance shall only be used to pay the cost of repointing of masonry originally assumed not to require such repairs.
    - a. Brick Masonry (Modular units measuring 3-5/8" x 2-1/4" x 7-5/8"):  
\$ \_\_\_\_\_ SF
    - b. CMU Masonry (Modular units measuring 7-5/8" x 7-5/8" x 15-5/8"):  
\$ \_\_\_\_\_ SF
  2. Provide a linear foot allowance for epoxy repair of existing masonry/concrete cracks, fissures or similar irregularities not otherwise identified in the Contract Documents to require repair. All similar epoxy repairs identified elsewhere in the Contract Documents shall be included in the Base Bid and shall not be paid for as a part of this Allowance. This Allowance shall only be used to pay the cost of epoxy repair of masonry/concrete originally assumed not to require such repairs.
    - a. Brick Masonry: \$ \_\_\_\_\_ SF
    - b. CMU Masonry: \$ \_\_\_\_\_ SF
    - c. Concrete: \$ \_\_\_\_\_ SF
  3. Provide a square foot allowance for the removal and replacement of existing masonry units in kind not otherwise identified in the Contract Documents to require replacement. All masonry unit removal and replacement identified elsewhere in the Contract Documents shall be included in the Base Bid and shall not be paid for as a part of this Allowance. This Allowance shall only be used to pay the cost of removal of and replacement of masonry units originally assumed not to require such scope of work.
    - a. Brick Masonry (Modular units measuring 3-5/8" x 2-1/4" x 7-5/8"):  
\$ \_\_\_\_\_ SF
    - b. CMU Masonry (Modular units measuring 7-5/8" x 7-5/8" x 15-5/8"):  
\$ \_\_\_\_\_ SF
  4. Provide a square foot allowance for the parging and infill of bed joints and other block face irregularities at existing CMU infill masonry units scheduled to receive application of new weather barriers.
    - a. \$ \_\_\_\_\_ SF
- C. Alternate No. 3 (Existing CMU Substrate Wall and Steel Bar Joist Connection)
1. State the amount to be ADDED to the Base Bid to furnish and install repair and reinforcement requirements at existing CMU substrate walls as indicated per the Structural Drawings. See Structural Drawings (S-Series) for clarification.
- D. Alternate No. 4 (PCB Testing)
1. State the amount to be ADDED to the Base Bid to obtain representative samples of existing window and door caulking for analytical testing at a certified laboratory. Submit analytical report to Owner.

**PART 2 PRODUCTS - NOT USED****PART 3 EXECUTION - NOT USED****END OF SECTION**

**SECTION 01 30 00  
ADMINISTRATIVE REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Electronic document submittal service.
- B. Preconstruction meeting.
- C. Site mobilization meeting.
- D. Job meetings.
- E. Requests for Information.
- F. Construction reports.
- G. Construction Progress Schedule.
- H. Materials Schedule.
- I. Submittal Schedule.
- J. Progress photographs.
- K. Coordination Drawings.
- L. Shop Drawings.
- M. Approval Drawings.
- N. Product Data, Certifications, Delegated-Design Submittals
- O. Submittals for review, information, and project closeout.
- P. Submittal procedures.
- Q. Architect's Review

**1.02 RELATED REQUIREMENTS**

- A. Section 01 00 00 - General Requirements.
- B. Section 01 78 10 - Warranties.
- C. Section 01 78 00 - Project Close-out: Project record documents.

**1.03 PROJECT COORDINATION**

- A. Project Coordinator: Contractor.
- B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for delivery access, traffic, and parking facilities.
- C. During construction, coordinate use of site and facilities through the Project Coordinator.
- D. 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.
- E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities.
- F. Coordinate field engineering and layout work under instructions of the Project Coordinator.
- G. Make the following types of submittals to Architect through the Project Coordinator:
  - 1. Requests for interpretation.
  - 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.

**PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.1 ELECTRONIC DOCUMENT SUBMITTAL SERVICE**

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format 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 information (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. It is Contractor's responsibility to submit documents in PDF format.
  - 3. Subcontractors, suppliers, and Architect's consultants are to be permitted to use the service at no extra charge.
  - 4. 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.
  - 5. Paper document transmittals will not be reviewed; emailed PDF documents will not be reviewed.
  - 6. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
- B. Cost: The cost of the service is to be paid by Contractor; include the cost of the service in the contract sum.
- 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.

### **3.2 PRECONSTRUCTION MEETING**

- A. Project Coordinator will schedule a meeting after Notice of Award.
- B. Agenda:
  - 1. Introductions of attendees and their Project duties.
  - 2. Execution of Owner- Contractor Agreement.
  - 3. Submission of executed bonds and insurance certificates.
  - 4. Distribution of Contract Documents.
  - 5. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
  - 6. Designation of personnel representing the parties to Contract , Contractor, Owner and Architect.
  - 7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
  - 8. Procedures and safety plan for use of and access throughout the existing building and site in coordination with ongoing Owner activities.
    - a. Review of the Emergency procedures and contacts.
  - 9. Scheduling.
    - a. Particular focus to be the review of the Work Phasing Plan as submitted and agreed to by the Owner.
  - 10. See Section 01 00 00 General Requirements
- C. Contractor shall record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

### **3.3 SITE MOBILIZATION MEETING**

- A. The Contractor shall schedule a meeting at the Project site prior to his occupancy.
- B. Project Coordinator will schedule meeting at the Project site prior to Contractor occupancy.
- C. Attendance Required:
  - 1. Contractor.
  - 2. Owner.
  - 3. Architect.
  - 4. Contractor's Superintendent.
  - 5. Major Subcontractors.
- D. Agenda:
  - 1. Use of premises by Owner and Contractor.
  - 2. Owner's requirements and occupancy prior to completion.
  - 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. Procedures and safety plan for use of and access throughout the existing building and site in coordination with ongoing Owner activities.
    - a. Review of the Emergency procedures and contacts.
  - 8. Schedules.
  - 9. Application for payment procedures.
  - 10. Scope and procedures for testing and inspections. Review of Statement of Special Inspections and Testing Agency duties.
  - 11. Procedures for maintaining record documents.
  - 12. Requirements for start-up of equipment.
  - 13. Inspection and acceptance of equipment put into service during construction period.
- E. Contractor shall record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

### **3.4 JOB MEETINGS**

- A. Schedule and administer meetings throughout progress of the Work at maximum bi-monthly intervals.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required:
  - 1. Contractor.
  - 2. Owner.
  - 3. Architect.
  - 4. Contractor's Superintendent.
  - 5. Major Subcontractors.

- D. 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 including submission and presentation of the two week look ahead schedule.
  - 7. Corrective measures to regain projected schedules.
  - 8. Planned progress during succeeding work period.
  - 9. Maintenance of quality and work standards.
  - 10. Review of testing and inspection reports.
  - 11. Effect of proposed changes on progress schedule and coordination.
  - 12. Other business relating to Work.
- E. Contractor shall record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

### **3.5 CONSTRUCTION REPORTS**

- A. The Contractor's superintendent shall maintain an on-site daily construction log, recording the following information concerning events at the site and allow access to the Owner and Architect for review.
  - 1. List of subcontractors at the site.
  - 2. Approximate count of personnel at the site.
  - 3. Visitors at the site.
  - 4. High and low temperatures, general weather conditions.
  - 5. Accidents and unusual events.
  - 6. Meetings held at the site.
  - 7. Communications received or conveyed by the superintendent.
  - 8. Stoppages, delays, shortage, losses.
  - 9. Meter readings and similar recordings.
  - 10. Emergency procedures.
  - 11. Orders and requests of governing authorities.
  - 12. Testing agency observations and tests.
  - 13. Change orders received and implemented.
  - 14. Services connected, disconnected.
  - 15. Significant deliveries.
  - 16. Equipment or system tests and start-ups.
  - 17. Partial completions, occupancies.
  - 18. Substantial Completions authorized.
  - 19. Masonry reports.

### **3.6 REQUESTS FOR INFORMATION**

- A. Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified. All RFIs shall be submitted to the Architect through the Contractor.
- B. Content of the RFI shall include the Project name and number, date, name of Contractor, RFI number, assigned sequentially, RFI subject, Specification Section number and paragraph number, as applicable, Drawing and detail number as applicable, field dimensions and conditions as applicable, Contractor's suggested resolution and any impact on time or cost, Contractor's signature. Attach any sketches, descriptions, photos or other information relevant to fully describe items needing interpretation.
- C. Architect's Action: Architect will review each RFI, determine action required and respond. Allow 10 working days for Architect's response to each RFI. Architect's action may include a request



for additional information. If the Contractor believes the RFI response warrants a change in Contract Time or the Contract Sum, notify the Architect in writing within 10 days of receipt of the RFI response.

- D. RFI Log: Prepare, maintain and submit an RFI log organized by RFI number. Submit log weekly. Include date RFI was submitted and date of Architect's response.
- E. On receipt of Architect's action, update RFI log and distribute response to affected parties. Notify Architect within 7 days if Contractor disagrees with response.

### **3.7 CONSTRUCTION PROGRESS SCHEDULE**

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review. All significant construction activities shall be represented. Time duration shall be in weekly increments. If work is planned in phases, provide scheduling for each phase. Schedules shall be coordinated with Owner's on-going occupancy, as applicable.
  - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
  - 2. Provide a detailed two week look ahead schedule indicating anticipated type of work, areas of work to occur, access required by Contractor, interruptions to Owner activities (as applicable), other items or activities critical to or of importance to ongoing activities by both the Contractor and Owner.
- D. Time Frame: Schedule shall extend from date established for the Notice to Proceed to the date of Final Completion. Contract completion date shall not be changed unless specifically authorized by Change Order.
- E. Activities: Define activities so no activity is longer than 20 days, unless allowed by the Architect. Include procurement process activities for long lead items and major items. Include review and submittal time. Include not less than 30 days for start-up and testing. Include key milestones for commissioning activities such as documentation, time and duration of testing. Indicate date of Substantial Completion and allow time for Architect's activities necessary for certification of Substantial Completion. Include time indicated in Form of Agreement for completion of punchlist items and final completion. If not indicated, include not more than 60 days.
- F. Include constraints and work restriction indicated in the Contractor Documents and show how the sequence of Work is affected, including phasing, work under multiple contracts, work by Owner, coordinating with existing construction, uninterruptible services, premises use restrictions, and other work restrictions.
- G. Include important stages of construction and milestones including, but not limited to, Notice to Proceed, Completion of each phase, if applicable, Substantial Completion and Final Completion.
- H. Gantt-Chart Schedule: Submit a comprehensive fully developed horizontal Gantt-chart type Contractor's Construction Schedule within 14 days of date established for the Notice of Award. Base schedule on the Preliminary Construction Schedule and whatever updating and feedback was received since the start of the Project.
- I. Submit biweekly look ahead schedules at each job meeting.
- J. Submit updated overall project schedule with each Application for Payment.

### **3.8 CONTRACTOR'S SCHEDULE OF MATERIALS**

- A. Within twenty-one (21) days after date established for the Commencement of the Work, prepare and submit to the Architect a projected schedule for materials delivery, clearly identifying all products with long lead times or which are likely to cause delay due to unavailability, extended delivery dates or any other reason. Once approved, long lead times shall be pre-ordered in a timely manner as not to delay the progress of the Work. The Contractor shall assume full responsibility for delays attributed to unavailability, insufficient time

for delivery and/or installation of materials or performance of the Work, unless he has conformed with these instructions.

### **3.9 CONTRACTOR'S SUBMITTAL SCHEDULE**

- A. Within ten (10) days after development and acceptance of the Contractor's Construction Schedule, prepare and submit to the Architect a complete schedule of submittals. Coordinate schedule with subcontractors and provide adequate time for review, processing and the possibility of non-acceptance and resubmission. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of ordering materials or performance of the Work to permit processing. Update schedule as necessary.

### **3.10 PROGRESS PHOTOGRAPHS**

- A. Submit a minimum of 20 digital photographs with each application for payment, taken not more than 7 days prior to submission of Application For Payment.
  - 1. Identify project name, date, description of view and key plan of location if needed.
- B. Maintain one set of all photographs at Project site for reference; same copies as submitted, identified as such.
- C. Provide auxiliary lighting as required to produce clear, well-lit photographs without obscuring shadows. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion
- D. Photography Type: Digital; electronic files.
- E. Provide photographs of site and construction throughout progress of Work produced by an experienced photographer, acceptable to Architect.
- F. In addition to periodic, recurring views, take photographs of each of the following events:
  - 1. Excavations in progress.
  - 2. Completion of demolition showing conditions of existing substrate structures.
  - 3. Completion of repairs and/or replacement of existing substrates where applicable.
  - 4. Completion of installation of weather barrier systems including associated flashings and other terminations.
- G. Digital Photographs: 24 bit color, minimum resolution of 1280 by 960 ("1 megapixel"), in JPG format; provide files unaltered by photo editing software.
  - 1. Delivery Medium: On photo CD, flash drive, e-mail or link to on-line file share site either hosted by the Contractor or other, such as DropBox.
  - 2. File Naming: Include project identification, date and time of view, and view identification.

### **3.11 SHOP DRAWINGS**

- A. Shop Drawings: Shop drawings include fabrication and installation drawings, coordination drawings, setting diagrams, schedules, patterns, templates, and similar drawings specially prepared for the Work by the Contractor, subcontractors, manufacturers, fabricators, suppliers or distributors to illustrate some portion of the Work.
  - 1. Shop drawings shall show the design, dimensions, connections, and other details necessary to ensure the accurate interpretation of the Contract Documents and shall show adjoining Work in such detail as required to provide for proper connection to same. Where adjoining Work requires shop drawings, they shall be submitted concurrently for a coordinated review.
  - 2. Submit information specifically prepared for this Project, drawn to accurate scale. Do not reproduce Construction Documents or copy standard information as the basis for shop drawings. Standard information prepared without specific reference to the Project is not considered a shop drawing. Clearly and specifically indicate deviations from the Contract Documents.
  - 3. In addition to the above, include the following information:
    - a. Dimensions and notation of dimensions established by field measurements.
    - b. Identification of products and materials included.

- c. Compliance with specified standards.
  - d. Notation of coordination requirements and specific procedures.
  - e. Utility connections for equipment.
  - f. Identification of any change, variance or non-conformance with requirements of Contract Documents. Indicate with a "cloud" and provide detailed notation including reason for each change. Include completed "Contractor's Substitution Request" (See Section 01 60 00).
  - g. Indication by the Contractor that he has reviewed, coordinated (checked for dimension, quantity, relationship with work of all trades involved and is in accordance with the Contract requirements), and approved the Shop Drawing for submittal to the Architect.
4. Electronic Media: See Section 01 00 30 - Electronic Media, for information regarding obtaining electronic documents and their limited use for purposes of project coordination and the Contractor's use in the preparation of submittals.
- a. Unless express written permission of the Architect is granted, electronic documents provided by the Architect and his consultants, shall not be used by the Contractor, or any of his subcontractors of any tier or any materials supplier or vendor as a shop drawing or any other type of submittal or as the basis for preparing such shop drawing or submittal, with the sole exception to this prohibition being that electronic documents may be used as backgrounds upon which to prepare shop drawings or other submittals.

### **3.12 COORDINATION DRAWINGS**

- A. Coordination Drawings are a special type of shop drawing prepared by various trades to show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.
- 1. The Contractor shall arrange coordination meetings and require attendance of each (major) subcontractor in order to establish priorities for systems installation, to establish systems installation sequences, to determine and resolve potential conflicts, and to ensure that each trade has coordinated its work with the others and will honor commitments to other disciplines.
  - 2. Each subcontractor's representative shall sign the final coordination drawings, prior to submission for Architect's review, certifying they have coordinated each building system, resolved all potential conflicts between each trade's work, and have satisfied the intent of each disciplines design.
  - 3. Where potential conflicts cannot be resolved without input from, or review by, the Architect, the Contractor shall request said input/review, in writing, and provide all sketches, details, part plans, etc. necessary to convey fully the essence of the situation and/or potential conflict. The Contractor and all appropriate subcontractors shall make themselves available to meet with the Architect as required to resolve the issue(s) in question.
  - 4. Coordination Drawings shall be required for all building structure, ductwork, and piping systems.

### **3.13 APPROVAL DRAWINGS**

- A. Whenever the Contractor or subcontractor is required to submit Shop Drawings and/or Product Data to the Authority Having Jurisdiction over the Project for review and approval of a particular component or system, prior to starting on-site work, the Contractor shall submit to the Architect two (2) copies of the approved documents including the authority stamp and approving signature. Submit as "For Information Only".

### **3.14 RECORD DRAWINGS**

- A. Record Drawings: See Section 01 78 00 - Project Close-out.

**3.15 PRODUCT DATA**

- A. Compile Product Data into a single submittal for each element of construction or complete system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, materials test reports, color charts, roughing-in diagrams, templates, and wiring diagrams. Mark each copy to show applicable choices and options.
  - 1. Identify any change, variance, or non-conformance with requirements of Contract Documents with a "cloud" and provide detailed notation including reason for each change. Provide a completed "Contractor's Substitution Request" (see Section 01 60 00).

**3.16 CERTIFICATIONS**

- A. Certifications from manufacturers and/or installers required in individual Specification Sections shall be submitted with Product Data.
  - 1. In accordance with Supplementary General Conditions, Article 3, prior to Substantial Completion, the Contractor shall submit a written certificate that no asbestos and/or other hazardous substances have been incorporated into the Work of this Project.
  - 2. Contractor's Asbestos/Hazardous Material Certification with the following language:
    - a. I, \_\_\_\_\_ the undersigned representing (company), do hereby certify that the products furnished and/or fabricated and/or installed by my firm under contract with (G.C. or C.M.) at the (Project) located in (project location) do not contain asbestos and /or other hazardous materials.
    - b. Provide signature, title and date.
    - c. The form of certificate shall be submitted to the Architect for review prior to use.

**3.17 DELEGATED-DESIGN SUBMITTALS**

- A. Where professional engineering services or certifications by a professional engineer are specifically required to be provided by the Contractor, provide products and systems complying with specific performance and design criteria indicated.
  - 1. If criteria indicated are not sufficient to perform services or certifications required, submit a written request for additional information to the Architect.
  - 2. In addition to Shop Drawings, Product Data, and other required submittals, submit a certification, signed and sealed by the responsible professional engineer, licensed in the State of the Project, for each product and system specifically assigned to the Contractor to be engineered or certified by a professional engineer, indicating that the products and systems are in compliance with performance and design criteria indicated. Include a list of codes, loads, and other factors used in performing these services.

**3.18 SUBMITTALS FOR REVIEW**

- A. When the following are specified in individual Sections, submit 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 conformance with information given and the design concept expressed in the contract documents.
- C. Samples will be reviewed only for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below.

**3.19 SUBMITTALS FOR INFORMATION**

- A. When the following are specified in individual Sections, submit 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. No action will be taken.

### **3.20 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:
  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.

### **3.21 NUMBER OF COPIES OF SUBMITTALS**

- A. Documents for Review: Submittals to the Architect shall be electronic files in PDF format, unlocked, markable and reproducible; an electronically-marked up file will be returned. Create PDFs at native size and right-side up. Illegible files will be returned. In addition to electronic files, the following types of submittals shall also be submitted in hard copy, quantity indicated:
  1. Steel rebar (2).
  2. Structural steel and deck (2).
  3. Doors and Frames (1).
  4. Door hardware (1).
  5. Millwork and casework (1).
  6. Sprinkler shop drawings (2).
  7. Fire alarm shop drawings (2).
  8. Small Size Sheets, Not Larger Than 11 x 17 inches.
  9. Large Size Sheets, Not Larger Than 30 x 42 inches. .
- B. Documents for Information: Submit three copies.
- C. Samples: Confirm with the Architect the number of samples required for each submittal; 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.

### **3.22 SUBMITTAL PROCEDURES**

- A. Shop Drawing Procedures:
  1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work.
  2. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.
- B. Transmit each submittal with a copy of approved submittal form.
- C. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
- D. Submittal form shall include identification information: Project name, Contractor, Subcontractor or supplier; product name, pertinent drawing and detail number, and specification section number, submittal category, date, and total number of pages in the submittal.
- E. Contractor's Action and Certification: The Contractor shall review each submittal, check for compliance with the Contract Documents, note corrections, note field dimension, and complete a review stamp with the following information:
  1. Contractor stamp, signed or initialed certifying that the submittal conforms to requirements of the Contract Documents in accordance with AIA A201, Paragraph 3.12.; or, Submittal

- deviates from requirements of the Contract Documents, with deviations clearly noted and marked with Contractor's initials; or, Contractor's substitution requested.
- F. Deliver submittals to Architect at business address. Submittals may only be sent directly to the Architect's consultants by special arrangement with the Architect. Subcontractors shall not directly send submittals to the Architect.
  - G. Submittals of poor legibility may be returned without action.
  - H. Submittals not including a completed Contractor's Certification will be returned without action.
  - I. Submittals certified as in conformance by the Contractor and found to deviate from requirements of the Contract Documents will be returned without action.
  - J. The Contractor may require sub-contractors to submit similar certification, however this shall not in any way relieve the Contractor of responsibility for review and certification of all submittals.
  - K. All notations made on submittals by the Contractor, sub-contractors, suppliers, or fabricators shall be made in bold line type and initialed by person making the notations. Clearly indicate specified items with a "cloud" or arrows. Cross out all extraneous information not intended as part of the submission. Do NOT use highlighter or colored markings, only arrows, circles, text and the like that can be copied in black and white shall be allowed.
  - L. Provide a detailed notation of all deviations from the Contract Document requirements including minor variations and limitations, and the reason for each deviation. Include a Contractor's Substitution Request.
  - M. Contractor's Substitution Request: All requests for substitutions shall be submitted on the form included at the end of Section 01 60 00 - Product Requirements.
  - N. Schedule submittals to expedite the Project, and coordinate submission of related items.
  - O. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
  - P. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
  - Q. Provide space for Contractor and Architect review stamps.
  - R. When revised for resubmission, identify all changes made since previous submission.
  - S. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
  - T. Submittals not requested will not be recognized or processed.
  - U. Do not order materials or proceed with the Work requiring submission and review of Product Data, Shop Drawings, Samples or similar submittals prior to receiving acceptance of the submittal from the Architect.
  - V. The Contractor shall not use or take submittals on-site without the Architect's or the Architect's consultant's Submittal Stamp indicating acceptance. Submittals without this stamp or with a stamp indicating non-acceptance shall not be used in connection with construction.

### **3.23 ARCHITECT'S REVIEW**

- A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Architect will review each submittal and mark to indicate action taken.
  - 1. In general, the Architect will strive to complete his review of submittals and return them to the Contractor in approximately two (2) weeks. Additional time may be required if large volumes of submittals are simultaneously delivered to the Architect for review. Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow three (3) weeks for initial review of each submittal.
  - 2. The Architect will not review submittals of colors and finishes until submittals for all such related materials are complete and delivered for collective review. This same

- requirement may be extended to other components and systems as deemed appropriate by the Architect.
3. The Architect's review shall, among other limitations, not include the calculation, coordination, or verification of dimensions or quantities, which shall be the sole responsibility of the Contractor.
  4. Action Stamp: The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows to indicate the action taken:
    - a. Final Unrestricted Release: Where submittals are marked "No Exceptions Taken", that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents.
    - b. Final-but-Restricted Release: Where submittals are marked "Note Markings" or "Comments Attached" or "Revise and Resubmit Record Copy", that part of the Work covered by the submittal may proceed provided it complies with markings / comments and requirements of the Contract Documents.
    - c. Returned for Resubmittal: Where submittals are marked "Revise and Resubmit for Further Review", do not proceed with that part of the Work covered by the submittal including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat as necessary to obtain a different action mark.
    - d. Rejected: When the submittal is marked "Rejected", do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Do not resubmit that product.
- B. Other Action: Where a submittal is primarily for record purposes, the submittal will be returned marked "Received and Distributed for Record Only". Where a submittal cannot be reviewed due to lack of Contractor review or illegibility, for example, the submittal will be returned marked "Returned No Action".

#### **END OF SECTION**

**SECTION 01 40 00  
QUALITY REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Samples, Mock-ups and Sample Field Installations.
- B. References and standards.
- C. Testing and inspection agencies and services.
- D. Control of installation.
- E. Tolerances.
- F. Manufacturers' field services.
- G. Defect Assessment.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 00 00 - General Requirements.
- B. Section 01 21 00 - Allowances: Allowance for payment of testing services.
- C. Section 01 30 00 - Administrative Requirements: Submittal procedures.
- D. Section 01 45 33 - Code-Required Special Inspections: Project testing and inspections required by the building code and AHJ.

**1.03 DEFINITIONS**

- A. Code or Building Code: 2009 Edition of the International Building Code, Chapter 17 - Structural Tests and Inspections.
- B. Authority Having Jurisdiction (AHJ): Agency or individuals officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
- C. Special Inspections:
  - 1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the building code and AHJ that also require special expertise to ensure compliance with the approved contract documents and the referenced standards.
  - 2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

**1.04 REFERENCE STANDARDS**

- A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2014).
- B. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2014.
- C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2013.
- D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.
- E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing; 2014a.
- F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2013.
- G. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2010.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Contractor's Testing Agency Qualifications: Prior to start of Work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible



- officer.
- C. Contractor's Test Reports: After each test/inspection, promptly submit one copy of reports to Architect, Engineer, Building Official and to Owner. Information required on Test Reports shall be as identified herein for the Owner's Testing Agency.
    - 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. Conformance 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 conformance 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 conforms to 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 within 10 days of observation to Architect and Owner for their information.
    - 1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.
  - G. Erection Drawings: Submit drawings to the Architect and Owner for their information.
    - 1. Submit for information for the sole and limited purpose of generally assessing conformance with the design intent expressed in the Contract Documents.
    - 2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

#### **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. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

- C. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

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

- A. Quality control services include inspections, tests, and related actions including reports performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect.
- B. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.
- C. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.
- D. Inspections, tests and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
- E. Requirements for the Contractor to provide quality control services as directed by the Architect, Owner, or Authorities Having Jurisdiction are not limited by the provisions of this Section.
- F. The Owner will employ services of an independent testing agency(s) to perform Special Inspections and certain specified tests and inspections specified by the Owner; payment for cost of services will be derived from allowance specified in Section 01 21 00; see Section 01 21 00 and applicable sections for description of services included in allowance.
- G. The Contractor shall employ and pay for services of an independent testing agency to perform other specified testing and inspection. See paragraph TESTING AND INSPECTIONS.
- H. Testing and Inspection Agencies Quality Assurance:
  - 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.

#### **1.08 SPECIAL TESTS AND INSPECTIONS**

- A. Special Tests and Inspections: Conducted by Special Inspectors as indicated in the Statement of Special Inspections, appended to Section 01 45 33 - Code-Required Special Inspections. Special Inspectors shall:
  - 1. Verify that manufacturer maintains detailed fabrication and quality-control procedures and review the completeness and adequacy of those procedures to perform the Work.
  - 2. Notify AHJ, Architect, Structural Engineer of Record, Contractor and Owner promptly of irregularities and deficiencies observed in the Work during performance of its service.
  - 3. Submit a certified written report of each test, inspection, and similar quality-control service to AHJ, Architect, Structural Engineer of Record, Owner and Contractor.
  - 4. Submit a final report of special tests and inspections, identifying any unresolved deficiencies to AHJ, Architect, Structural Engineer of Record, Owner and Contractor.
  - 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Construction Documents.
  - 6. Retesting and re-inspecting corrected work.

**PART 2 PRODUCTS - NOT USED****PART 3 EXECUTION****3.1 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.

**3.2 SAMPLES, MOCK-UPS AND SAMPLE FIELD INSTALLATIONS**

- 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. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- E. Tests shall be performed under provisions identified in this Section and identified in the respective product Specification Sections.
- F. Assemble and erect specified items at full scale, with specified attachment and anchorage devices, flashings, seals, and finishes.
- G. 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.
- H. The purpose of mock-ups and sample field installations shall be to clearly establish standards of quality for the Work prior to proceeding with the Work itself. They shall be constructed in sizes, locations and quantities as directed by the Architect.
- I. To the extent possible, all samples, mock-ups and sample field installations accepted by Architect shall be preserved until the Work itself has been completed and accepted by the Architect. The alteration, destruction or removal of mock-ups and sample installations shall not commence without the Architect's prior authorization.
- J. The Contractor and/or his subcontractors shall construct or prepare all samples, mock-ups and sample field installations as required in individual Specification Sections or as directed by the Architect.

- K. Sample field installations are full sized, fully fabricated, cured, and finished built in-place assemblies that maybe permanent if acceptable to the Architect.
- L. Samples shall be clearly marked with the manufacturer's name, generic description of the sample and compliance with required standards. Where samples are for selection of color, pattern, texture, or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.
- M. All costs related to providing, maintaining and removing required samples, mock-ups and sample field installations shall be paid by the Contractor.

### **3.3 TOLERANCES**

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

### **3.4 TESTING AND INSPECTIONS**

- A. See Section 01 45 33 - Code Required Special Inspections, and individual Specification Sections for testing and inspections required.
- B. Testing Agency Duties and Responsibilities:
  - 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 (within 24 hours) Owner, Architect and Contractor of observed irregularities or non-conformance of Work or products during performance of its services.
  - 6. Perform additional tests and inspections required by Architect.
  - 7. Verify samples submitted by Contractor comply with the referenced standards and the approved contract documents.
  - 8. Attend preconstruction meetings and progress meetings, as requested.
  - 9. Submit written reports of all tests, inspections or other services to the AHJ, Architect, Structural Engineer of Record, Owner and Contractor. Reports indicating compliant inspections shall be submitted within three (3) days. Reports shall include:
    - a. Date of issue.
    - b. Project name and number.
    - c. Name, address, and telephone number of testing agency.
    - d. Dates and locations of samples and tests or inspections.
    - e. Names of individuals making tests or inspections.
    - f. Designation of the Work and test method.
    - g. Identification of product and Specification Section.
    - h. Complete inspection or test data.
    - i. Test results and interpretations of test results.
    - j. Ambient conditions at time of sample taking, testing, or inspection.
    - k. Comments or professional opinion regarding whether inspected or tested Work complies with the Contract Documents.
    - l. Recommendations for re-testing.
    - m. Name and signature of laboratory inspector.
  - 10. The Testing Agency shall maintain a complete deficiency list of all items not corrected and shall re-test and/or re-inspect as required after each deficiency has been corrected. All such re-testing and re-inspection shall be at the Contractor's expense. The Testing Agency shall submit a final signed report, stating whether or not all corrections have been made and the Work tested and inspected conforms to the Contract Documents.

11. Limits on Testing/Inspection Agency Authority:
  - a. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
  - b. Agency may not approve or accept any portion of the Work.
  - c. Agency may not assume any duties of Contractor.
  - d. Agency has no authority to stop the Work.
- C. Owner Duties and Responsibilities:
  1. The Owner will provide Special Inspections, observations, inspections, tests and similar quality control services specified to be performed by independent agencies, except where they are specifically indicated as the Contractor's responsibility or are provided by another identified entity. The costs for Owner provided testing and inspection services shall be paid for by the Owner.
  2. The Owner will employ directly an independent agency, testing laboratory, or other qualified firm to perform Special Inspections and other testing that are the Owner's responsibility. See Section 01 45 33 - Special Inspections and individual Specification Sections for the scope of such inspections and tests.
  3. See Section 01 45 33 - Code Required Special Inspections for scope of those inspections.
  4. Such individual Specification Sections for the scope of other inspections and tests which shall include be not be limited to:
    - a. Division 9: Concrete slab moisture humidity and Ph testing.
- D. Contractor's Testing and Inspections:
  1. The Contractor shall provide inspections, tests and similar quality control services, specified in individual Specification Sections, except where they are specifically indicated to be the Owner's responsibility, or are provided by another identified entity. Costs for these services shall be included in the Contract Sum.
  2. The Contractor shall employ and pay an independent testing agency to perform quality control services, including but not limited to inspections, sampling and tests required for determining the suitability of materials prior to delivery to the site, field testing, and other services as specified in the Specification Sections. Such inspections and tests shall include, but may not be limited to the following:
    - a. Division 1: Indoor air quality.
    - b. Division 3: Concrete mix designs and pre-construction tests.
    - c. Division 3: Cast underlayment cylinder compression testing, if required.
    - d. Division 3: GFRC water absorption testing.
    - e. Division 4: Pre-construction unit masonry testing.
    - f. Division 7: Sealant field testing.
    - g. Division 8: Storefront field water leakage testing.
    - h. Division 8: Curtain wall field water leakage testing.
    - i. Division 9: Wall substrate moisture testing for paints and coatings.
    - j. Division 21: Fire suppression system testing.
    - k. Division 22: Piping systems testing.
    - l. Division 23: HVAC systems.
    - m. Division 23: Piping systems testing.
    - n. Division 26, 27, 28: Electrical systems testing.
    - o. Division 32: Analysis of loam.
    - p. Where the Owner has engaged a testing agency or other entity for testing and inspection of a part of the Work and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Owner, unless otherwise agreed in writing with the Owner.
- E. Contractor Duties and 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. Scheduling: Notify Testing Agency, Special Inspector, Owner's Representative and, Architect sufficiently in advance of operations to allow for the proper assignment of personnel and scheduling of testing and inspections.
- F. Re-testing:
1. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by the Special Inspector and/or Architect.
  2. Re-testing required because of non-conformance to specified requirements shall be paid for by the Contractor.
  3. The Contractor is responsible for re-testing where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with the Contract Document requirements, regardless of whether or not the original test was the Contractor's responsibility. Cost of re-testing construction revised or replaced by the Contractor is the Contractor's responsibility.
- G. Indoor Air Quality Testing:
1. The Contractor shall engage the services of a Certified Industrial Hygienist, using an AIHA accredited laboratory to comply with RSA 10-B, Chapter 1800 Occupational Health Rules (New Hampshire Air Quality Act).
    - a. In accordance with New Hampshire He-P1804.05 Standards, the following shall be tested and certified: Noise, Radon, Carbon Dioxide, Formaldehyde, Mold, and Mildew.
    - b. The Contractor shall forward the Certified Industrial Hygienists data analysis reports to the Owner.
    - c. The Contractor shall provide a clean air certification to the Owner immediately following Substantial Completion. Receipt of the certification shall be a condition of Final Payment.

### **3.5 MANUFACTURERS' FIELD SERVICES**

- A. When specified in individual Specification Sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
- B. Report in writing, observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

### **3.6 DEFECT ASSESSMENT**

- A. Replace Work or portions of the Work not conforming to specified requirements.

## **END OF SECTION**

**SECTION 01 45 33  
CODE-REQUIRED SPECIAL INSPECTIONS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Code-required special inspections.
- B. Submittals.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 40 00 - Quality Requirements: General requirements for testing and inspections and project testing and inspections other than Special Inspections.

**1.03 DEFINITIONS**

- A. Code or Building Code: 2009 Edition of the International Building Code, Chapter 17 - Structural Tests and Inspections.
- B. Authority Having Jurisdiction (AHJ): Agency or individuals officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
- C. Special Inspections:
  - 1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the building code and AHJ that also require special expertise to ensure compliance with the approved contract documents and the referenced standards.
  - 2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

**1.04 REFERENCE STANDARDS**

- A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.
- B. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.
- C. AISC 341 - Seismic Provisions for Structural Steel Buildings; 2010.
- D. AISC 360 - Specification for Structural Steel Buildings; 2010.
- E. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.
- F. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement ; 2015.
- G. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field ; 2012.
- H. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete ; 2010.
- I. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.
- J. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing; 2014a.
- K. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2013.
- L. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2010.
- M. IAS AC291 - Accreditation Criteria for Special Inspection Agencies; 2012.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Special Inspectors Qualifications: Prior to the start of work, proposed Special Inspectors shall submit their qualifications to the AHJ for review and acceptance.

- C. Testing & Inspections Agency Qualifications: Prior to the start of work, the Testing & Inspections Agency shall submit the following to the AHJ, Architect, Structural Engineer of Record, Owner and Contractor:
  - 1. Agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
  - 2. 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. Documentation that Testing Agency is accredited by IAS according to IAS AC89.
- D. Special Inspection Reports: After each special inspection, all Special Inspectors and Testing Agencies shall promptly submit copies of their report to Architect, Structural Engineer of Record, Owner, Contractor, and AHJ at intervals identified on the Statement of Special Inspections.
  - 1. Include:
    - a. Date issued.
    - b. Project title and number.
    - c. Name of Special Inspector.
    - d. Date and time of special inspection.
    - e. ICC, AWS and ACI certification #s.
    - f. Identification of product and Specifications Section.
    - g. Location in the Project.
    - h. Type of test or special inspection.
    - i. Date of test or special inspection.
    - j. Results of test or special inspection. Failing inspections and tests, as well as retests shall be clearly identified.
    - k. Conformance with Contract Documents.
  - 2. Final Special Inspection Report: Each Special Inspector shall submit a Final Report upon the conclusion of each special inspection regime. Document special inspections and correction of failed testing and inspections, corrective action and successful re-tests in a final report to be submitted to the AHJ, Architect, Structural Engineer of Record, Contractor and Owner.
  - 3. The Architect as Registered Design Professional in Responsible Charge shall assemble all Final Reports submitted by the Special Inspectors, determine that all required test and inspection reports have been submitted, and submit a Project Final Report Summary to the AHJ, Owner and Contractor.
- E. Fabricator Special Inspection Reports: After each special inspection of fabricated items at the Fabricator's facility, Special Inspector shall promptly submit copies of report to Architect, Structural Engineer of Record, Contractor, Owner and AHJ.
  - 1. Include:
    - a. Date issued.
    - b. Project title and number.
    - c. Name of Special Inspector.
    - d. Date and time of special inspection.
    - e. Identification of fabricated item and specification section.
    - f. Location in the Project.
    - g. Results of special inspection.
    - h. Verification of fabrication and quality control procedures.
    - i. Conformance with Contract Documents.
    - j. Conformance to referenced standard(s).
- F. Test Reports: After each test or inspection, promptly submit copies of report to Architect, Structural Engineer of Record, Contractor, Owner and AHJ.
  - 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 or inspection.
- h. Date of test or inspection.
- i. Results of test or inspection.
- j. Conformance with Contract Documents.

#### **1.06 TESTING AND INSPECTION AGENCIES**

- A. The Owner shall employ services of an independent testing and inspection agency and/or agencies to perform inspections and tests associated with Special Inspections required by the building code.
  - 1. The Owner will employ services of an independent testing agency to perform certain other testing and inspections that are not Special Inspections as identified in Section 01 40 00.
  - 2. The Contractor shall employ services of an independent testing agency(s) to perform certain other testing and inspections that are not Special Inspections as identified in Section 01 40 00.
- B. Employment of agency(s) in no way relieves the Contractor of the obligation to perform the Work in accordance with requirements of the Contract Documents.

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

### **PART 3 EXECUTION**

#### **3.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL**

- A. Frequency of Special Inspections: Special Inspections are indicated as continuous, periodic, or aperiodic.
  - 1. Continuous Special Inspection: Approved individual of the Special Inspection agency shall be present in the area where the work is being performed and observe the work at all times the work is in progress.
  - 2. Periodic Special Inspection: Approved individual of the Special Inspection agency shall be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.
  - 3. Aperiodic Special Inspection: Approved individual of the Special Inspection agency shall be present in the area where work is being performed and observe the work irregularly scheduled as required or as needed.

#### **3.02 TESTING AGENCY AND INSPECTORS DUTIES AND RESPONSIBILITIES**

- A. See Section 01 40 00 – Quality Requirements, for general duties and responsibilities of the testing agency and inspectors.

#### **3.03 CONTRACTOR DUTIES AND RESPONSIBILITIES**

- A. See Section 01 40 00 – Quality Requirements, for the duties and responsibilities of the Contractor.

#### **3.04 STATEMENT OF SPECIAL INSPECTIONS**

- A. See the appended Statement of Special Inspections following this Section, for the scope of building code and AHJ required testing and inspections for this Project.

**END OF SECTION**

## Statement of Special Inspections

Portsmouth Senior Activity Center

December 27, 2018

Project Name Portsmouth Senior Activity Center  
Location: 125 Cottage Street, Portsmouth, New Hampshire  
Owner: City of Portsmouth  
1 Junkins Avenue, Portsmouth, New Hampshire 03801

Engineer of Record (EoR): & Registered Design Professional in Responsible Charge (RDPIRC):	Tim Nichols, PE AECm 13 Water St, Newmarket, NH 03857	603-209-0096
Architect of Record (AoR)	Brian Murphy MannyPenny   Murphy Architecture	603-319-8199
Structural Engineer of Record (SER):	Paul Becker, P.E. Becker Structural Engineers Inc	207-879-1838x101
Testing Agency(s) (TA):	To Be Determined	
Geotechnical Engineer (GE):	To Be Determined	
Commissioning Agency (CA):	To be determined	
Specialty Engineer(s) (SE):	To be determined	

This Statement of Special Inspections is submitted as a condition for permit issuance in accordance with the Special Inspection and Structural Testing requirements of the International Building Code, 2009 edition.

The firms, agencies, or individuals noted above (hereafter referred to collectively as agents) will perform the structural tests and inspections as specified herein.

The complete set of Construction Documents (Drawings and Specifications) that accompany the application for building permit is to be considered attached to this program as reference material.

This program does not relieve the Contractor of their responsibility to conduct the work in accordance with the requirements of the Construction Documents, the approved Shop Drawings and the New Hampshire State Building Code.

**Construction Categories:** The following construction categories are included in the Statement of Special Inspections for this Project. Specific tests and inspections required for each designated category are listed on the page noted opposite the category.

<u>Construction Category</u>	<u>Page</u>	<u>Construction Category</u>	<u>Page</u>
Structural Steel Framing	<u>3-4</u>	In-situ Bearing Strata	<u>8</u>
Shear Connectors	<u>3-4</u>	Controlled Fill	<u>8</u>
Steel Joist Framing	<u>3-4</u>	Curtain wall	<u>9</u>
Steel Decking	<u>N.I.C</u>	Storefront	<u>10</u>
Cast-In-Place Concrete	<u>5-6</u>	Arch, Mech & Electrical Components	<u>12</u>
Masonry	<u>7</u>		
Earthwork	<u>8</u>		

**Performance Specifications:** The following construction components are designated in the Construction Documents on the basis of a performance specification to be designed by the Contractor's or Subcontractor's registered professional engineer, i.e. Specialty Engineer - SE.

<u>Construction Component</u>	<u>Page</u>
Curtainwall	<u>9</u>
Storefront	<u>10</u>
Aluminum Window	<u>11</u>
Cold Formed Metal Framing	<u>13</u>

**Reports:** Test and inspection reports prepared by the EOR, AOR, SER, TA, GE, and SE will be collected and maintained by the RDPiDC and distributed, according to the procedures established by the Building Official. Prior to the issuance of a certificate of occupancy the RDPiDC will submit a final report to the Owner and Building Official in accordance with the Building Code.

Prepared by the SER:

Name: Paul Becker, P.E.  
New Hampshire Professional Engineer Registration # 6258 (Structural)

Signature: \_\_\_\_\_

Firm: Becker Structural Engineers Inc

Date: \_\_\_\_\_

Registered Design Professional in Responsible Charge:

Name: Tim Nichols, P.E.  
New Hampshire Licensed Engineer #12349

Signature: \_\_\_\_\_

Firm: AECm

Date: \_\_\_\_\_

<b>Steel Construction</b> <b>(IBC 2009 Section 1704.3)</b> <b>(Specification Sections 051200, 052100 &amp; 053100)</b>					
Item	Tests / Inspections	Code, Standard, or Document Reference	Agency	Type of Inspection <sup>1,2,3</sup>	Frequency
1. Steel Construction QC Review	<ul style="list-style-type: none"> <li>Review Contractor's field quality control procedures.</li> <li>Review frequency and scope of field testing and inspections.</li> </ul>	Spec. Section 051200	SER	-	Each submittal
2. Fabricator Certifications	<ul style="list-style-type: none"> <li>Review AISC Certified Fabricator Submittals.</li> </ul>	AISC (Fabricator) Certification Standard for Steel Building Structures (STD) or alternate acceptance criteria (per Section 051200 – 1.04 – C – 2)	SER	-	Each submittal
	<ul style="list-style-type: none"> <li>For record and use in field verification</li> </ul>		TA	Periodic	In conjunction with related field visits
3. Materials	<ul style="list-style-type: none"> <li>Review material certifications for conformance to Specifications.</li> </ul>	AISC 360 A3.1 AISC 360 A3.3 & 3.4 Spec. Section 051200	SER	-	Each submittal
	<ul style="list-style-type: none"> <li>For record and use in field verification</li> </ul>		TA	Periodic	In conjunction with related field visits
4. Anchor Rods	<ul style="list-style-type: none"> <li>Review Contractor's as-built survey.</li> <li>Verify that all anchor rods have been properly torqued and have adequate fit-up.</li> </ul>	ASTM F1554 AISC 360 M4 Spec. Section 051200	TA	Periodic	Verify bolt length, projection and condition. Verify "Snug tight" torque for 100% of anchor bolts in braced bays, 20% in all other cases.
5. Bolting	<ul style="list-style-type: none"> <li>Verify bolt size and grade.</li> <li>Test and inspect bolted connections.</li> </ul>	AISC 360 A3.3 & M2.5 Spec. Section 051200 AISC Specification for Structural Joints Using A325 or A490 Bolts	TA	Continuous (Slip-critical)  Periodic (Bearing)	As appropriate for connection type and fastener type. Per Construction Documents and AISC specifications.
			SER	-	SER to review conditions identified as critical
6. Welding	<ul style="list-style-type: none"> <li>Check welder qualifications.</li> <li>Check weld identification markings.</li> <li>Test and inspect welds.</li> </ul>	AWS D1.1 Section 6 Spec. Section 051200	TA	<u>Continuous:</u> •Complete and partial penetration groove welds, •Multiple pass fillet welds, •Plug and slot welds •Single pass fillet welds >5/16"  <u>Periodic:</u> •Fillet welds ≤ 5/16"	<u>Atcomplete andpartialpenetration groove welds:</u> Visually inspect and test all welds by ultrasonic or radiographic methods. If for an individual welder, the rejection rate is demonstrated to be five (5) percent or less, the non-destructive testing rate may be reduced to twenty-five (25) percent for the individual welder. The evaluation of the welding shall be based on a sampling of at least forty (40) completed welds and completed by an AWS Certified Weld Inspector.  <u>Atallother welds:</u> Visually inspect all welds and test as required by magnetic particle, ultrasonic or radiographic methods and shall be completed by an AWS Certified Weld Inspector.
			SER	-	During aperiodic site visits

**Statement of Special Inspections**  
Portsmouth Senior Activity Center

December 27, 2018

7. Structural Framing, Details, and Assemblies	<ul style="list-style-type: none"> <li>• Check against Construction Documents and latest approved shop drawings.</li> <li>• Inspect for size, grade of steel, camber, installation, and connection details.</li> <li>• Verify steel frame joint details including: <ul style="list-style-type: none"> <li>• Details such as bracing and stiffeners</li> <li>• Moment connections</li> <li>• Joint configurations and locations</li> <li>• Preparation of faying surfaces</li> </ul> </li> </ul>	Construction Documents Spec. Section 051200	TA	Periodic	All framing, details, and assemblies.
			SER	-	SER to review conditions identified as critical
8. Expansion & Adhesive Anchors	<ul style="list-style-type: none"> <li>• Review installation procedures for both mechanical anchors and adhesive anchors.</li> <li>• Verify that materials are suitable for job conditions.</li> </ul>	ACI 318 Appendix D Anchor manufacturer's instructions	TA	Periodic	All anchors
			SER	-	Each submittal
9. Steel Decking	<ul style="list-style-type: none"> <li>• Verify gage, depth, and type.</li> <li>• Inspect placement, laps, welds, side lap attachments, and mechanical fasteners</li> <li>• Check welder qualifications.</li> </ul>	SDI Steel Deck Design Manual AWS D1.3 Section 7 Construction Documents Spec. Section 053100	TA	Periodic	All decking and connections, inspection shall be completed by a AWS Certified Weld Inspector.
			SER	-	SER to review conditions identified as critical
10. Field Correction of Fabricated Items	<ul style="list-style-type: none"> <li>• Review documentation of approved repairs and verify completion of repairs.</li> </ul>	Construction Documents Spec. Section 051200	TA	As required, per above	Each repair
			SER	-	SER to review conditions identified as critical

<sup>1</sup>Continuous Inspection: Full-time observation of the indicated work by approved individual of the noted Agency, as the work is being performed.

<sup>2</sup>Periodic Inspection: Part-time or periodic observation of the indicated work by an approved individual of the noted Agency and an inspection of the completed work.

<sup>3</sup>Aperiodic Inspection: Irregularly scheduled as required or as needed observation of the indicated work by an approved individual of the noted Agency; Principal Inspection responsibility is that of the Testing Agent TA.

**Statement of Special Inspections**  
Portsmouth Senior Activity Center

December 27, 2018

<b>Concrete Construction  (IBC 2009 Section 1704.4)  (Specification Section 033000)</b>					
Item	Tests / Inspections	Code, Standard, or Document Reference	Agency	Type of Inspection <sup>1,2,3</sup>	Frequency
1. Cast in Place Concrete Construction QC Review	<ul style="list-style-type: none"> <li>Review Contractor's field quality control procedures.</li> <li>Review frequency and scope of field testing and inspections.</li> </ul>	Construction Documents Spec. Section 033000	SER	-	Each submittal
2. Mix Design	Review mix designs prior to placement.	Construction Documents Spec. Section 033000	SER	-	Each submittal
	Verify use of approved mix design.	ACI 318, 1.3.2.A ACI 318, Chapter 4 ACI 318, 5.2-5.4	TA	-	Each concrete placement
3. Materials	Review material certifications for conformance to Specifications.	Construction Documents Spec. Section 033000	SER & TA	-	Each submittal
4. Batching Plant	Review plant quality control procedures and batching/mixing methods.	ACI 304	TA	-	One (1) visit at the start of production & one (1) during the production period. Additional visits may be requested by the SER, if necessary.
5. Reinforcement Installation	<ul style="list-style-type: none"> <li>Use latest set of approved reinforcing bar shop drawings.</li> <li>Inspect reinforcing for grade, size, quantity, spacing, lap lengths, bends, hooks, condition, and placement.</li> <li>Verify adequate cover per specifications.</li> <li>Confirm dowel installation for masonry and concrete, including embedment lengths.</li> </ul>	ACI 318, 1.3.2.C ACI 318, 7.5	TA	Periodic	Each concrete placement
			SER	-	SER to review conditions identified as critical
6. Anchor Rods	Inspect anchor rods prior to and during placement of concrete.	ACI 318 1.3.2.C	TA	Continuous	All anchor rods
			SER	-	SER to review conditions identified as critical
7. Formwork	Inspect forms for cleanliness and for proper sizes/locations of concrete members.	ACI 318 6.1.1	TA	Periodic	Each concrete placement
			SER	-	SER to review conditions identified as critical

**Statement of Special Inspections**  
Portsmouth Senior Activity Center

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8. Concrete Placement and Sampling of Fresh Concrete	• Review hot-weather and cold-weather placement procedures submitted by the Contractor.	ACI 305ACI 306	SER	-	Each submittal
	• Verify conformance to Specifications including hot-weather and cold-weather placement procedures.	ACI 305 ACI 306	TA	-	Each concrete placement
	• Observe concrete placement operations. • Check that total water does not exceed amount in design mix.	ACI 318, 1.3.2.D ACI 318, 5.9-5.10	TA	Continuous	Each concrete delivery
			SER	-	SER to review conditions identified as critical
	• Concrete Strength	ASTM C31, C39 & C172	TA	-	For each strength of concrete, each day, take six (6) standard 6"x12" cylinders for the first placement up to 50 CY. Then take six (6) additional cylinders for every 50 CY thereafter. Take sample from point of discharge and at time fresh concrete is placed. Concrete for each set of cylinders shall be from (1) representative sample of the entire batch.
	• Concrete Slump	ASTM C143			
	• Concrete Air Content	ASTM C231			
	• Concrete Temperature	ASTM C1064			
10. Evaluation of Concrete Strength	• Test and evaluate in accordance with the Specifications.	Construction Documents Spec. Section 033000 ACI 214 ASTM C42	TA	-	(1) 7-day & (2) 28-day results. Hold (2) for 56-day results, as needed.
			SER	-	Each submittal
11. Curing and Protection	• Observe procedures for conformance to the Specifications.	Construction Documents Spec. Section 033000	TA	Periodic	Each concrete placement
			SER	-	SER to review conditions identified as critical
12. Welding Reinforcing Steel	• Verify that rebar is ASTM A706 and observe preheating as necessary.	ACI 318, 3.5.2 ASTM A706 AWS D1.4, Section 7	TA	Continuous	Visual inspection of all welds
13. Mechanical Reinforcing Splices	• Confirm that the correct, approved couplers are being used. • Verify proper embedment, joint fit-up, and tightness of mechanical parts.	ACI 318, Chapter 12 & Manufacturer's installation instructions	TA	Periodic	Visual inspection of all splices

<sup>1</sup>Continuous Inspection: Full-time observation of the indicated work by approved individual of the noted Agency, as the work is being performed.

<sup>2</sup>Periodic Inspection: Part-time or intermittent observation of the indicated work by an approved individual of the noted Agency and an inspection of the completed work.

<sup>3</sup>Aperiodic Inspection: Irregularly scheduled as required or as needed observation of the indicated work by an approved individual of the noted Agency; Principal Inspection responsibility is that of the Testing Agent TA.

<sup>4</sup>TA shall coordinate initial visit with SER to review reinforcing inspection requirements.

**Statement of Special Inspections**  
Portsmouth Senior Activity Center

December 27, 2018

<b>Masonry Construction</b> <b>(IBC 2009 Section 1704.5)</b> <b>(Specification Section 042000)</b>					
Item	Tests / Inspections	Code, Standard, or Document Reference	Agency	Type of Inspection <sup>1,2</sup>	Frequency
1. Tests Submitted by Contractor for Masonry Units/ Assemblages	<input type="checkbox"/> Review mortar, grout, and prism tests submitted by Contractor.	Construction Documents Spec. Section 042000 ACI 530.1 Art. 1.5	AOR <sup>2</sup>	-	Each class of masonry unit and type of masonry assemblage.
2. Materials Certification	<input type="checkbox"/> Review masonry units, masonry veneers, precast masonry units, and mortar and grout materials.	Construction Documents Spec. Section 042000 ACI 530.1 Art. 1.4B	AOR <sup>2</sup>	-	Each submittal
	<input type="checkbox"/> For record and field verification		TA		In conjunction with related field visits
3. Testing & Evaluation of Mortar & Grout Strength	<input type="checkbox"/> Sample and test mortar and grout used in field for masonry construction.	Construction Documents Spec. Section 042000 ACI 530.1 Art. 1.4B	TA	-	For each type of mortar and grout, per every 5,000 square feet of wall surface area: test mortar per ASTM C780 test grout per ASTM C1019
	<input type="checkbox"/> Review test results for mortar and grout.		AOR <sup>2</sup>	-	Each report
4. Proportioning, Mixing, and Consistency of Mortar & Grout	<input type="checkbox"/> Observe field procedures for proportioning and mixing of the mortar and grout to be used in the masonry construction.	Construction Documents Spec. Section 042000 ACI 530.1 Art. 2.6	TA	Continuous	Once, for each type of grout, at the beginning of masonry construction
			AOR <sup>2</sup>	-	AOR to review conditions identified as critical
5. Masonry Installation	<input type="checkbox"/> Inspect and report on installation of masonry units for general configuration and placement.	Construction Documents Spec. Section 042000 ACI 530.1 Art. 3.3	TA	Periodic	All locations
			AOR <sup>2</sup>	-	AOR to review conditions identified as critical
6. Anchorage	<input type="checkbox"/> Inspect type, spacing, and placement of masonry anchors and ties.	ACI 530 Sections 1.2.2.e & 1.16.1	TA	Periodic	All locations
			AOR <sup>2</sup>	-	AOR to review conditions identified as critical
7. Reinforcement Installation	<input type="checkbox"/> Inspect reinforcement for grade, size, quantity, spacing, condition, cover, bar positioners, and placement.	Construction Documents Spec. Section 042000 ACI 530 Section 1.15 ACI 530.1 Art. 2.4 & 3.4	TA	Periodic	All locations
			AOR <sup>2</sup>	-	AOR to review conditions identified as critical
8. Grouting Operations	<input type="checkbox"/> Inspect cells of masonry units for cleanliness prior to grouting. Observe partial/full grouting procedures.	Construction Documents Spec. Section 042000 ACI 530.1 Art. 2.6B	TA	Continuous	All locations
			AOR <sup>2</sup>	-	AOR to review conditions identified as critical
9. Weather Protection	Review submittal on protection of masonry against cold and hot weather.	IBC Sections ACI 530.1 Articles 1.8C & 1.8D	AOR <sup>2</sup>	-	Each submittal
	<input type="checkbox"/> Observe protection of masonry against cold and hot weather.		TA	Periodic	Each masonry placement
10. Anchorage of Exterior Wall Masonry Veneer	<input type="checkbox"/> Inspect type, size, spacing, and placement of approved anchorage to adjacent back-up framing.	Construction Documents Spec. Section 042000 ACI 530 Section 1.2.2.e	TA	Periodic	All locations
			AOR	-	Each submittal

<sup>1</sup>Continuous Inspection: Full-time observation of the indicated work by approved individual of the noted Agency, as the work is being performed.



<b>Soils</b> <b>(IBC 2009 Section 1704.7)</b> <b>(Specification Section 31 23 15)</b>					
Item	Tests / Inspections	Code, Standard, or Document Reference	Agency	Type of Inspection <sup>1,2,3</sup>	Frequency
1. Excavation	☐ Review existing sub-soils and groundwater conditions during building excavation.	Construction Documents Spec. Section 320000	GE	Periodic	At each location
2. Bearing Strata	☐ Review the in-situ bearing strata and compacted structural fill bearing strata for footings and slabs cast on grade.	Construction Documents Spec. Section 320000	GE	Periodic	At each location
3. Structural Fill	☐ Observe and test compacted structural fill.	Construction Documents Spec. Section 320000	GE	Continuous	At each location
4. Field Conditions	☐ Review existing conditions, procedures and in-situ bearing strata for underpinning.	Construction Documents Spec. Section 314000	GE	Continuous	At each location
5. Concrete Placement	☐ Observe concrete placement operations.	Construction Documents Spec. Sections 033000 & 314000	GE	Periodic	See Concrete Construction Requirements
6. Earthwork	☐ Observe and test excavation and soil placement	Construction Documents Spec. Section 312000	TA & GE & Contractor	Periodic	Each Submittal & As noted in Construction Documents

<sup>1</sup>Continuous Inspection: Full-time observation of the indicated work by approved individual of the noted Agency, as the work is being performed.

<sup>2</sup>Periodic Inspection: Part-time or intermittent observation of the indicated work by an approved individual of the noted Agency and an inspection of the completed work.

<sup>3</sup>Aperiodic Inspection: Irregularly scheduled as required or as needed observation of the indicated work by an approved individual of the noted Agency; Principal Inspection responsibility is that of the Testing Agent TA.

**Statement of Special Inspections**  
Portsmouth Senior Activity Center

December 27, 2018

<b>Glazed Aluminum Curtain Walls</b> <b>(IBC 2009 Section 1704.15)</b> <b>(Specification Section 084410)</b>					
Item	Tests / Inspections	Code, Standard, or Document Reference	Agency	Type of Inspection <sup>1,2</sup>	Frequency
1. Glazed Aluminum Curtainwalls	<input type="checkbox"/> Review supplier's structural design of system.	Construction Documents Spec. Section 084410	SER	-	Each submittal
2. Material Certification	<input type="checkbox"/> Review materials used.	Construction Documents Spec. Section 084410	SER	-	Each submittal
	<input type="checkbox"/> For record and use in field verification.		TA		In conjunction with related field visits
3. Installation of Glazed Aluminum Curtainwalls	<input type="checkbox"/> Inspect type, size, gauge, spacing, and placement of members for conformance to the approved Curtain Wall Shop Drawings and Construction Documents. <input type="checkbox"/> Inspect member-to-member connections and connections/anchorage to adjacent steel/concrete/wood support elements.	Construction Documents Spec. Section 084410 Manufacturer's installation instructions	TA	Periodic	All locations
			SE	-	Once during performance of the work and once after completion of the work
4. Field Testing: Water Intrusion	<input type="checkbox"/> Operable Components: AAMA 502. <input type="checkbox"/> Fixed Components: AAMA 501.2.	Construction Documents Spec. Section 084410	CA	-	All locations

<sup>1</sup>Continuous Inspection: Full-time observation of the indicated work by approved individual of the noted Agency, as the work is being performed.

<sup>2</sup>Periodic Inspection: Part-time or intermittent observation of the indicated work by an approved individual of the noted Agency and an inspection of the completed work.

<b>Architectural, Mechanical and Electrical Components  (IBC 2009 Section 1707)  Building Seismic Design Category: C</b>					
Item	Tests / Inspections	Code, Standard, or Document Reference	Agency	Type of Inspection <sup>1,2</sup>	Frequency
1. Cladding & Walls	□ Inspection of air and vapor barrier/flashings installation	-	CA	-	Once during installation of wall systems mock-up.
				-	Once during performance of the work.
				Periodic	Upon the completion of air and vapor barrier/flashings prior to concealment by exterior cladding systems. DO NOT conceal areas without written approval that barrier/flashings have been inspected and approved by CA.

<sup>1</sup>Continuous Inspection: Full-time observation of the indicated work by approved individual of the noted Agency, as the work is being performed.

Cold Formed Metal Framing Construction (IBC 2009 Section 1704.3) (Specification Section 054000)					
Item	Tests / Inspections	Code, Standard, or Document Reference	Agency	Type of Inspection <sup>1,2</sup>	Frequency
1. Cold Formed Metal Exterior Wall Stud Backup Framing Design and Cold Formed Metal Roof Truss Design	<input type="checkbox"/> Review supplier's structural design of cold formed metal exterior wall stud backup framing and cold formed metal roof trusses.	Construction Documents Spec. Section 054000	SER	-	Each submittal
2. Materials Certification	<input type="checkbox"/> Review certification of materials.	AISI Cold Formed Steel Design Manual Construction Documents Spec. Section 054000	SER	-	Each submittal
	<input type="checkbox"/> For record & field verification		TA		In conjunction with related field visits
3. Installation of Cold Formed Metal Exterior Wall Stud Backup Framing	<input type="checkbox"/> Inspect type, size, gauge, spacing and placement of cold formed metal exterior wall studs, connections, anchorage, bridging, accessories, etc. for conformance with the approved Shop Drawings and Construction Documents.	AISI Cold Formed Steel Design Manual Construction Documents Spec. Section 054000	TA	Periodic	All locations
			SE	-	Once during performance of the work and once after completion of the work

<sup>1</sup>Continuous Inspection: Full-time observation of the indicated work by approved individual of the noted Agency, as the work is being performed.

<sup>2</sup>Periodic Inspection: Part-time or intermittent observation of the indicated work by an approved individual of the noted Agency and an inspection of the completed work.

**SECTION 01 50 00  
TEMPORARY FACILITIES**

**PART 1 GENERAL**

**1.1 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. Project identification sign.
- I. Field offices.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 00 00 - General Requirements.
- B. Section 01 40 00 - Quality Requirements.

**1.3 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

**1.4 QUALITY ASSURANCE**

- A. Comply with NFPA 241 Building Construction and Demolition Operations, ANSI A10 Safety Requirements for Construction and Demolition, AGC and ASC industry recommendations, and other applicable standards.
  - 1. Temporary electrical service shall comply with NECA Temporary Electrical Facilities, NEMA, UL and NFPA 70 National Electric Code.
- B. At the earliest time, when acceptable to the Owner, change over room use of temporary service to use of the permanent service.
- C. Operate temporary service and facilities in a safe and efficient manner, taking necessary fire prevention measures.

**1.5 TEMPORARY UTILITIES**

- A. Owner will provide the following:
  - 1. Electrical power, consisting of connection to existing facilities.
- B. Provide and pay for all drainage and stormwater, lighting, water, heating and cooling, and ventilation required for construction purposes.
- C. Use trigger-operated nozzles for water hoses, to avoid waste of water.

**1.6 TELECOMMUNICATION SERVICES**

- A. Telecommunications services shall include:
  - 1. Job Site computer dedicated to project telecommunications, with necessary software and laser printer and DSL or faster internet connection.
  - 2. Telephones: Cell phones for all construction field supervisors.
  - 3. E-mail: Account/address reserved for project use.

**1.7 TEMPORARY SANITARY FACILITIES**

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Use of existing facilities is not permitted.
- C. Maintain daily in clean and sanitary condition.

**1.8 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, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

**1.9 FENCING**

- A. Construction: Commercial grade chain link fence.
- B. Provide 6-foot-high fence around construction site phasing; equip with vehicular and pedestrian gates with locks.
  - 1. Fence perimeter shall be indicated per the Work Phasing Schedule Plan required per Section 01 00 00. As the phasing sequence progresses the Contractor shall update the perimeter fence plan as required to accommodate phase sequence and ensure the safety of workers and the general public. Owner approval of layout is required.

**1.10 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.
- B. See Section 01 00 00: Phasing and Work Scheduling for additional related requirements.

**1.11 INTERIOR ENCLOSURES**

- A. Provide temporary partitions 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 gypsum board sheet materials with closed joints and sealed edges at intersections with existing surfaces:
  - 1. Where temporary partitions separate Owner-occupied areas from unconditioned construction areas insulate partitions to R15.
- C. Paint surfaces exposed to view from Owner-occupied areas.

**1.12 SECURITY**

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

**1.13 VEHICULAR ACCESS AND PARKING**

- 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. Designated existing on-site roads may be used for construction traffic with prior approval by the Owner.
  - 1. Special Attention: Existing facility and site will remain operational throughout construction. All vehicular access and parking shall be noted on the Work Phase Plan submitted to the Owner for approval prior to start of work. Delivery schedules are to be coordinated with Owner activities to ensure ongoing operations will not be compromised.
    - a. Delivery schedules shall be included within the two weeks look ahead schedule required per Section 01 00 00.

- F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

#### **1.14 WASTE REMOVAL**

- A. See Section 01 74 19 - Construction Waste Management, 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.

#### **1.15 PROJECT IDENTIFICATION**

- A. Provide project identification sign.
- B. Erect on site at location approved by Owner and governing authorities.
- C. No other signs are allowed without Owner permission except those required by law.
- D. Size: 8' x 4' (unless otherwise required by local authorities) The Contractor shall be required to furnish and erect the Project sign complete in all respects, and to dismantle when so instructed by the Owner.
- E. Content: Display names and addresses of the Project, Owner, Architect, and Contractor. Graphics, text, lettering, colors, and location shall be provided by the Architect and approved by the Owner, at a later date.
- F. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors. Do not permit installation of unauthorized signs. No other signs or advertisements shall be displayed on the premises without the approval of the Owner.

#### **1.16 FIELD OFFICES**

- A. The Contractor shall provide and maintain an insulated, weather tight, field office at the site. The office shall be of sufficient size to accommodate required office personnel and meeting place for six people. Provide electrical service, heat, lighting, telephone, fax machine, and personal computer, Internet connected with e-mail capability and printer. At a minimum, furnish with a desk and chair for each Superintendent, conference table and chairs, 4-drawer file cabinet, plan table, plan rack, and bulletin board. Equip with a water cooler and first aid cabinet unit. Existing facilities and/or new construction shall not be available for this purpose.
- B. Temporary offices shall be maintained until the issuance of a Certificate of Substantial Completion and shall be removed when no longer required. The Contractor shall pay all costs in connection with the construction, servicing, maintenance, and removal of temporary offices.

#### **1.17 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. Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition.

### **PART 2 PRODUCTS**

#### **2.1 PRODUCTS**

- A. Tarpaulins: Waterproof, fire-resistant, UL labeled, with flame spread rating of 15 or less.
- B. Water: Potable water.
- C. Fencing: Shall be galvanized two (2) inch chain link fabric not less than six (6) feet high with galvanized steel pipe posts.

### **PART 3 EXECUTION**

**3.1 GENERAL**

- A. Review locations of temporary facilities, equipment, and storage with the Architect and Owner, for the Owner's approval.
- B. Use qualified personnel for the installation of temporary facilities. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

**3.2 TEMPORARY UTILITY INSTALLATION**

- A. Temporary Water Service: The Contractor shall:
  - 1. Provide and maintain a temporary water service or install the permanent water service as required for the proper execution of the Work. Such service shall be installed in a manner approved by governing authorities.
  - 2. Pay for the installation and removal of any temporary service, and for all water used throughout the construction period.
  - 3. Pay for permits, if applicable, as required by governing authorities. Obtain easements across private property if required.
  - 4. Extend a supply adequate for all construction purposes and convenient to all trades.
  - 5. Protect lines against freezing and be fully responsible for the temporary installation in every way.
  - 6. Provide backflow preventer(s), vacuum breakers, etc., as required to protect water systems from contamination.
  - 7. Provide any and all hose needed. All service hoses shall be bubble-tight at all times. Trigger operated nozzles shall be used to reduce water waste. No leakage shall be acceptable. Remove all temporary equipment and materials completely upon completion of construction.
  - 8. Repair all damage caused by use of temporary or permanent water services.
- B. Temporary Electrical Services: The Contractor shall provide and maintain temporary light and power for the execution of the Work of this Contract. The existing electrical service may be used for temporary lighting and power providing that it is safe and adequate, and its use is acceptable to governing authorities. Should the Contractor determine that the existing service is not suitable for use as temporary lighting and power, he shall arrange for temporary electric services and pay for all charges of installation and removal of same. Such services shall be installed and maintained in conformance with NEMA, NECA, UL standards for temporary electric service, National Electric Code and in a manner approved by the governing authorities. The Owner will pay monthly user charges throughout the construction period, providing such charges are not excessive or otherwise unreasonable. The Contractor shall:
  - 1. Pay for permits, if applicable, as required by governing authorities. Obtain easements across private property if required. Comply with National Electrical Code, latest edition and applicable local codes and utility regulations.
    - a. An electrical permit from the City of Portsmouth Electrical Inspector is required.
  - 2. Extend from the source a supply of temporary lighting and power adequate for all construction purposes and convenient to all trades.
  - 3. Accept full responsibility for the temporary installation in every way. Remove all temporary equipment and materials completely upon completion of construction.



4. Whenever overhead roof deck has been installed, provide temporary lighting with local switching. Install and operate temporary lighting that will fulfill security and protection requirements, without operating the entire system, and will provide adequate illumination for construction operations and traffic conditions. Provide a minimum of one (1) lamp per story at interior stairways and ladder runs, located to illuminate each landing and flight.
5. Determine that construction use of power will not affect the operation or performance of any equipment or appliances within the existing building.
- C. Temporary Drainage and Storm Water Control: The Contractor shall provide drainage ditches, dry wells, stabilization ponds, and similar facilities. Filter out excessive amounts of soil, construction debris, chemicals, oils and similar contaminants that might clog sewers or pollute waterways before discharge. Maintain temporary drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains. Protect site from puddling or running water. Provide water barriers as required to protect site and abutting properties from soil erosion.
- D. Sanitary Facilities: The Contractor shall provide and maintain in a sanitary condition temporary toilets, wash facilities and drinking water fixtures complying with regulations and health codes for the type, number, location, operation and maintenance of fixtures and facilities.
  1. Toilets shall be enclosed, weather-tight chemical type for the use of all construction personnel at locations acceptable to the Owner and governing authorities. Toilet facilities within existing buildings may not be used by construction personnel. Permanent toilets installed under this Contract shall not be used during construction.
  2. Drinking water facilities shall be containerized tap-dispenser bottled water units, with paper cups.
  3. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste container for used materials. Maintain daily in clean and sanitary condition.
- E. Temporary Heat: The Contractor shall provide temporary heat to permit construction work to be carried on during the winter months and as required by construction activities for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. These Specifications are not to be construed as requiring heat for operations that are not adversely affected by the weather.
  1. The Contractor shall maintain a minimum temperature of 40 degrees F at the working surface, unless higher temperatures are required for specific work activities. This provision does not supersede any specific requirements for methods of construction, curing of materials, or the applicable General Conditions set forth in the Contract Documents with added regard to performance obligations of the Contractor.
  2. During the progress of the Work and at all times prior to the date of Substantial Completion, the Contractor shall provide temporary heat as required to prevent damage to completed work, work in progress or stored materials.
    - a. The Contractor shall provide independent temporary heating systems and shall pay all costs, including fuel, related thereto.
- F. Operating labor shall be provided by the Contractor for all heating equipment. Operating labor shall include frequent inspection, emergency repairs, and maintaining temperature records. The Contractor shall provide continuous direct attendance as appropriate or otherwise required by governing authorities.
  1. The installation and operation of heating devices used hereunder shall comply with all safety regulations, including provisions for adequate ventilation and fire protection. Select safe equipment that will not have a harmful effect on completed installation or elements being installed. Coordinate ventilation requirement to produce the ambient condition required and minimize consumption of energy. Use of gasoline burning space heaters, open flame, or salamander type heating units is prohibited. Ventilate enclosed

areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes vapors, or gases.

- G. Temporary Ventilation: Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

### **3.3 TEMPORARY SUPPORT FACILITIES INSTALLATION**

- A. Storage Sheds and Trailers: Existing facilities and/or new construction shall not be available for this purpose.
1. All field offices, storage sheds, and trailers located within the construction area, or within 30 feet of building lines shall be of non-combustible construction, complying with requirements of NFPA 241.
  2. Construction shanties, sheds, and temporary facilities provided as required above or for the Contractor's convenience shall be located as approved by the Owner and governing authorities and maintained in good condition and neat appearance.
- B. Temporary Stairs, Lifts, and Hoists: The Contractor shall furnish and maintain all equipment such as temporary stairs, ladders, ramps, scaffolds, runways, chutes, etc., as required for the proper execution of the Work, unless specifically included under the Work of other trades.
1. All such apparatus, equipment, and construction shall meet all requirements of applicable laws, regulations, and standards of safety and good practice.
  2. All hoisting equipment and machinery required for the proper and expeditious prosecution and progress of the Work shall be furnished, installed, operated, and maintained in safe condition by the Contractor for the use of all subcontractors' material and/or equipment delivered to the designated hoisting area. All costs for such equipment operating services shall be paid by the Contractor.
  3. If a particular subcontractor has certain specific requirements which are peculiar to his needs, and which cannot be satisfied with the hoist provided by the Contractor, the subcontractor shall provide, maintain, operate, and pay for hoisting equipment necessary for the proper execution and completion of his work.

### **3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION**

- A. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities, the Contractor shall provide and maintain in good operating condition temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses, and as recommended by representatives of the fire insurance company carrying insurance on the Work or by governing fire or building authorities. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations".
1. Flammable products shall be properly stored in containers acceptable to fire officials.
  2. The area within the site limits shall be kept orderly and clean, and all combustible rubbish shall be promptly removed from the site.
  3. Fire extinguishers shall be located where convenient and effective for their intended purpose, but not less than one extinguisher on each floor.
  4. Maintain unobstructed access to fire extinguishers, temporary fire protection facilities, stairways, and other access routes for fighting fires.
  5. Smoking shall be strictly prohibited on the construction site.
  6. Provide supervision of welding operations, soldering operations, combustion type temporary heating units, and similar sources of fire ignition.
- B. Barricades, Warning Signs and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed provide lighting, including flashing red or amber lights.
- C. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted, or that other

undesirable effects might result. Minimize the use of tools and equipment that produce excessive noise and restrict their use to hours that will minimize complaints from persons near the site.

- D. Temporary Enclosures: Provide temporary enclosure for protection of construction in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
  - 1. All cavities of masonry construction and masonry construction containing uncured mortar shall be covered during rainy conditions and at the end of a day's work.
  - 2. Where heat is needed, and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilation and material drying or curing requirements to avoid dangerous conditions and effects. This protection shall provide adequate working areas during winter months, consistent with the approved construction schedule to permit the continuous progress of all work necessary to maintain an orderly and efficient sequence of construction operations.
  - 3. Install tarpaulins securely, with non-combustible wood framing and other materials. Close openings 25 sq. feet or less with plywood or similar materials.
  - 4. Close openings through floor or roof decks and horizontal surfaces with load-bearing temporary construction. Where temporary wood or plywood is used and exceeds 100 sq. feet in area, use fire-retardant treated framing and plywood.
- E. Protective Covering of the Work: The Contractor shall protect all finished surfaces, including the jambs and soffits of all openings used as passageways or through which materials are handled, against any possible damage resulting from the conduct of work by all trades.
  - 1. All finished surfaces, including factory-finished and job-finished items, shall be clean and not marred upon delivery of the building to the Owner. The Contractor shall, without extra compensation, refinish all spaces where such surfaces prove to have been inadequately protected and are damaged.
  - 2. Tight wood sheathing shall be laid under any materials that are stored on or moved over finished surfaces. Reinforced non-staining kraft building paper and plywood or planking shall be laid over all types of finished floor surfaces in traffic areas before moving any material over these finished areas. Wheelbarrows, if used over such areas, shall have rubber-tired wheels.
  - 3. Roof surfaces shall not be subjected to unnecessary traffic nor shall they be used for storage of material. Wherever such activity must take place to carry out the Work of the Contract, adequate protection shall be provided.
  - 4. Prohibit traffic on grass and landscaped areas.
- F. Temporary Tree and Plant Protection: The Contractor shall provide temporary fencing adequate to properly protect existing trees to remain specifically identified on the Drawings during construction. Fencing shall be located at each tree's drip line to protect the tree's root structure as well as its trunk and branches. Damaged trees shall be replaced in-kind at the Contractor's expense.
- G. Worker I.D. Badges: The Contractor shall provide worker I.D. badges for all personnel present on the site involved with the Project. A list shall be maintained in the field office, identifying workers with their assigned badge number. Badges shall be prominently displayed always when on-site.

### **3.5 TERMINATION AND REMOVAL**

- A. Remove temporary facilities when the need has ended, or when replaced by authorized use of permanent facilities.
- B. Materials and facilities that constitute temporary facilities are the property of the Contractor.
- C. Repair or replace existing paving and curb areas damaged due to construction activities.

- D. At Substantial Completion, clean and restore permanent facilities that have been used during construction, including but not limited to, replacing air filters, cleaning ductwork, and replacing lamps effected by substantial use.

**END OF SECTION**

**SECTION 01 57 21  
INDOOR AIR QUALITY CONTROLS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Construction procedures to promote adequate indoor air quality after construction.
- B. Testing indoor air quality before commencement of construction; existing building areas only.
- C. Testing indoor air quality after completion of construction.

**1.2 PROJECT GOALS**

- A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
  - 1. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
  - 2. Establish condition of existing ducts and equipment prior to start of alterations.
- B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
  - 1. Furnish products meeting the specifications.
  - 2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

**1.3 REFERENCE STANDARDS**

- A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2012, with 2015 amendments.
- B. ASTM D5197 - Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology); 2009.
- C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; California Department of Public Health; v1.1, 2010.
- D. EPA 600/4-90/010 - Compendium of Methods for the Determination of Air Pollutants in Indoor Air; April 1990.
- E. EPA 625/R-96/010b - Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air; Jan-99.
- F. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction; 2007.

**1.4 DEFINITIONS**

- A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.
- B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.
- C. Particulates: Dust, dirt, and other airborne solid matter.
- D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

**1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Indoor Air Quality Management Plan: Describe in detail measures to be taken to promote adequate indoor air quality upon completion; use SMACNA (OCC) as a guide.
  - 1. Submit not less than 60 days before enclosure of building.
  - 2. Identify potential sources of odor and dust.
  - 3. Identify construction activities likely to produce odor or dust.

4. Identify areas of project potentially affected, especially occupied areas.
5. Evaluate potential problems by severity and describe methods of control.
6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.
7. Describe cleaning and dust control procedures.
- C. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.
- D. Duct and Terminal Unit Inspection Report.
- E. Air Contaminant Test Plan: Identify:
  1. Testing agency qualifications.
  2. Locations and scheduling of air sampling.
  3. Test procedures, in detail.
  4. Test instruments and apparatus.
  5. Sampling methods.
- F. Air Contaminant Test Reports: Show:
  1. Location where each sample was taken, and time.
  2. Test values for each air sample; average the values of each set of 3.
  3. HVAC operating conditions.
  4. Certification of test equipment calibration.
  5. Other conditions or discrepancies that might have influenced results.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Low VOC Materials: See other sections for specific requirements for materials with low VOC content.
- B. Auxiliary Air Filters: MERV of 8, minimum, when tested in accordance with ASHRAE Std 52.2.

## **PART 3 EXECUTION**

### **3.1 CONSTRUCTION PROCEDURES**

- A. Prevent the absorption of moisture and humidity by adsorptive materials by:
  1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
  2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
  3. Provide sufficient ventilation for drying within reasonable time frame.
- B. Begin construction ventilation when building is substantially enclosed.
- C. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area.
- D. Use of HVAC equipment and ductwork for ventilation during construction is not permitted:
  1. Provide temporary ventilation equivalent to 1.5 air changes per hour, minimum.
  2. Exhaust directly to outside.
  3. HVAC ductwork shall be kept clean, free of dust during storage, handling and installation. Seal HVAC air inlets and outlets immediately after duct installation with tape and plastic sheeting. All seams in ductwork shall be sealed.
- E. All inspection and filter replacement shall occur with the HVAC equipment turned off.
- F. Do not store construction materials or waste in mechanical or electrical rooms.
- G. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.
- H. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

### **3.2 AIR CONTAMINANT TESTING**

- A. Contractor's Option: Satisfactory air contaminant testing is required.
- B. Perform air contaminant testing before starting construction, as base line for evaluation of

- post-construction testing.
- C. Perform air contaminant testing before occupancy.
  - D. Do not start air contaminant testing until:
    - 1. All construction is complete, including interior finishes.
    - 2. HVAC systems have been tested, adjusted, and balanced for proper operation.
    - 3. New HVAC filtration media have been installed.
  - E. Indoor Air Samples: Collect from spaces representative of occupied areas:
    - 1. Collect samples while operable windows and exterior doors are closed, HVAC system is running normally as if occupied, with design minimum outdoor air, but with the building unoccupied.
    - 2. Collect samples from spaces in each contiguous floor area in each air handler zone, but not less than one sample per 25,000 square feet; take samples from areas having the least ventilation and those having the greatest presumed source strength.
    - 3. Collect samples from height from 36 inches to 72 inches above floor.
    - 4. Collect samples from same locations on 3 consecutive days during normal business hours; average the results of each set of 3 samples.
    - 5. Exception: Areas with normal very high outside air ventilation rates, such as laboratories, do not need to be tested.
    - 6. When retesting the same building areas, take samples from at least the same locations as in first test.
  - F. Outdoor Air Samples: Collect samples at outside air intake of each air handler at the same time as indoor samples are taken.
  - G. Analyze air samples and submit report.
  - H. Air Contaminant Concentration Limits:
    - 1. Formaldehyde: Not more than 27 parts per billion.
    - 2. PM10 Particulates: Not more than 50 micrograms per cubic meter.
    - 3. Total Volatile Organic Compounds (TVOCs): Not more than 200 micrograms per cubic meter.
    - 4. Chemicals Listed in CAL (CDPH SM) Table 4-1, except Formaldehyde: Allowable concentrations listed in Table 4-1.
    - 5. Carbon Monoxide: Not more than 9 parts per million and not more than 2 parts per million higher than outdoor air.
  - I. Air Contaminant Concentration Test Methods:
    - 1. Formaldehyde: ASTM D5197, EPA 625/R-96/010b Method TO-11A, or EPA 600/4-90/010 Method IP-6.
    - 2. Particulates: EPA 600/4-90/010 Method IP-10.
    - 3. Total Volatile Organic Compounds (TVOC): EPA 625/R-96/010b Method TO-1, TO-15, or TO-17; or EPA 600/4-90/010 Method IP-1.
    - 4. Chemicals Listed in CAL (CDPH SM) Table 4-1, except Formaldehyde: ASTM D5197, or EPA 625/R-96/010b Method TO-1, TO-15, or TO-17.
    - 5. Carbon Monoxide: EPA 600/4-90/010 Method IP-3, plus measure outdoor air; measure in ppm; report both indoor and outdoor measurements.
  - J. If air samples show concentrations higher than those specified, ventilate with 100 percent outside air and retest at no cost to Owner.

#### END OF SECTION

**SECTION 01 60 00  
PRODUCT REQUIREMENTS**

**PART 1 GENERAL****1.1 SECTION INCLUDES**

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

**1.2 RELATED REQUIREMENTS**

- A. Document 00 21 13 - Instructions to Bidders: Product options and substitution procedures prior to bid date.
- B. Section 01 00 00 - General Requirements.
- C. Section 01 40 00 - Quality Requirements: Product quality monitoring.

**1.3 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. See Section 01 30 00 - Administrative Requirements, for more information regarding product data submittals.
- 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. See Section 01 30 00 - Administrative Requirements, for more information regarding Shop Drawings.
- 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.

**PART 2 PRODUCTS****2.1 EXISTING PRODUCTS**

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.
- B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.
- C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

**2.2 NEW PRODUCTS**

- A. Provide new products unless specifically required or permitted by the Contract Documents.
- B. Do not use products made using or containing CFC's or HCFC's.
- C. Where all other criteria are met, Contractor shall give preference to products that:
  - 1. Are extracted, harvested, and/or manufactured closer to the location of the project.
  - 2. Have longer documented life span under normal use.
  - 3. Result in less construction waste.

**2.3 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 with product model: Use a product of one of the manufacturers named; no substitutions if so indicated; substitutions by following substitution procedures.
- C. Products Specified by Naming One manufacturer with other acceptable manufacturers listed without product model: Submit a request for substitution following substitutions procedures.

## **2.4 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**

### **3.1 SUBSTITUTION PROCEDURES**

- A. Substitutions are changes, modifications or deviations in those products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after the receipt of Bids. Substitutions for the convenience of the Contractor or subcontractors, or materials suppliers will only be considered if submitted prior to the receipt of Bids, in strict conformance with the Instructions to Sub-bidders.. The following shall not be considered substitutions:
  - 1. Changes, modifications, or deviations requested by Bidders during the bidding period and accepted prior to the receipt of Bids shall be considered as included in the Contract Documents and are not subject to the requirements of this Section.
  - 2. Revisions to Contract Documents requested by the Owner or Architect.
  - 3. Specified options of products or materials included in the Contract Documents.
  - 4. The Contractor's compliance with governing regulations and orders issued by governing authorities, subject to the Architect's prior written notice and approval.
- B. Substitution Requests: Request for substitution will be considered only if, in the opinion of the Architect, such substitution will be of benefit to the Owner. Substitution requests after receipt of bids will not be considered solely related to an "or approved equal" clause in the Contract Documents.
  - 1. The Contractor's substitution request will be considered by the Architect when all of the following conditions are satisfied, as determined by the Architect; otherwise requests will be returned without action.
    - a. Extensive revision to the Contract Documents are not required.
    - b. Proposed changes are in keeping with the general intent of the Contract Documents.
    - c. The request is timely, fully documented and properly submitted.
    - d. In addition to the above conditions, one or more of the following conditions must be satisfied, as determined by the Architect. The Contractor shall provide written documentation for each condition noted.
      - 1) The specified product cannot be provided within the Contract Time. However, the request will not be considered if the specified product cannot be provided as a result of the Contractor's failure to submit to the Architect or order from the manufacturer in a timely fashion.
      - 2) The specified product cannot receive necessary approval of governing authority and the requested substitution can be approved.
      - 3) A substantial advantage is offered to the Owner, in terms of cost savings, time savings, energy conservation, or other considerations of merit, after deducting

- offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.
- 4) The specified product cannot be provided in a manner that is compatible with or coordinated with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
  - 5) The specified product cannot provide the warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.
- C. Substitution Request Procedure: Complete the Contractor's Substitution Request form provided at the end of this Section. Submit electronically or three (3) hard copies of each request for substitution using the provided form with all required information. Incomplete forms will not be reviewed.
  - D. Architect's Action: Within five (5) working days of receipt, the Architect will request additional information to evaluate the substitution if any is required. Within ten (10) working days of receipt of all necessary information, the Architect will notify the Contractor of acceptance or rejection of the proposed substitute. If a decision on the use of a proposed substitute is not or cannot be made or obtained within the time allocated, the Contractor shall use the specified product. Acceptance will be in the form of a Change Order.
  - E. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this Section.
  - F. A request for substitution 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.
    2. Will provide the same or better 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.
  - G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

### **3.2 OWNER-SUPPLIED PRODUCTS**

- A. Owner's Responsibilities:
  1. Arrange for and deliver shop drawings, product data, certificates, manufacturer's instructions and samples, to Owner.
  2. Arrange and pay for product delivery to site in accordance with the progress schedule.
  3. On delivery, inspect products jointly with Contractor.
  4. Submit claims for transportation damage and arrange for replacement of 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. Submit to the Architect with notification of any observed discrepancies or problems anticipated due to non-conformance with the Contract Documents.
  2. Designating delivery dates for each product in accordance with the progress schedule.
  3. Receive and unload products at site; inspect for completeness or damage jointly with Owner. Record shortages, and damaged or defective items.
  4. Install blocking and supports as required for proper installation.
  5. Handle, uncrate, store, assemble, install, connect, adjust and finish products.
  6. Protecting products from damage and from exposure to the elements.

7. After receipt, repair or replace items damaged the Contractor or persons under his control.
- C. Owner furnished equipment for installation by the Contractor may be indicated on the Drawings, or otherwise identified for the Contractor's information. Concealed wood blocking shall be provided for mounting equipment. See Section 06 10 54. Such equipment shall include, but not be limited to:
  1. Clocks - surface mounted.
  2. TV and monitor mounting brackets - surface mounted.
  3. Interior signage - Surface mounted.

### **3.3 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. The Contractor shall be responsible for the proper protection from damage of all materials and equipment prior to and following their incorporation into the Work. Materials and equipment shall be inspected by the Contractor
- D. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- E. Transport and handle products in accordance with manufacturer's instructions.
- F. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- G. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, products are undamaged and if found to be damaged or otherwise unsuitable, shall be promptly rejected.
- H. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- I. Arrange for the return of packing materials, such as wood pallets, where economically feasible.
- J. All materials stored on or off the site shall be kept in secured, weathertight enclosures, and the Contractor shall correct, at no additional cost to the Owner, any damages resulting from his failure to provide proper protection. Such corrective work shall include total replacement if so required by the Architect.
- K. The Contractor shall exercise caution in temporarily loading materials on floors, decks, roofs, etc. It shall be the Contractor's responsibility to determine the size of loads to be imposed and the adequacy of the affected structure to support such loads. The Contractor shall correct, at no additional cost to the Owner, any resultant damages.

### **3.4 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.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

- G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- H. Comply with manufacturer's warranty conditions, if any.
- I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- J. Prevent contact with material that may cause corrosion, discoloration, or staining.
- K. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- L. 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**

**CONTRACTOR'S SUBSTITUTION REQUEST**

To Engineer: \_\_\_\_\_ Date: \_\_\_\_\_

From Contractor: \_\_\_\_\_ Number: \_\_\_\_\_

Specification Section: \_\_\_\_\_ Page: \_\_\_\_\_

Article / Paragraph: \_\_\_\_\_

1. Product data for proposed substitution to include: Description of product, reference standards, performance, and test data.  
 Sample attached: Yes \_\_\_ No \_\_\_ To be sent if requested by Architect Yes \_\_\_ No \_\_\_

2. Itemized comparison of proposed substitution with product specified is attached.

**ORIGINAL PRODUCT****PROPOSED SUBSTITUTION**

Trade Name, Model: \_\_\_\_\_

Manufacturer: \_\_\_\_\_

Installer: \_\_\_\_\_

History of proposed substitution: New product \_\_\_ 2-5 years old \_\_\_ 5-10 years old \_\_\_ &gt; 10 years old \_\_\_

Significant variations of proposed substitution from original product: \_\_\_\_\_

Proposed substitution affects other parts of the Work: No \_\_\_ Yes \_\_\_, explain \_\_\_\_\_

Similar installations within 150 miles: Provide project name, address, architect, install date: \_\_\_\_\_

Reason for not providing specified item: \_\_\_\_\_

3. Unit costs, if applicable: State if cost is materials only \_\_\_ or materials installed \_\_\_ .

Original product \$ \_\_\_ per \_\_\_\_\_ Substitution \$ \_\_\_ per \_\_\_\_\_

Savings to Owner for accepting substitution: \_\_\_\_\_ \$ \_\_\_\_\_

Proposed substitution changes Contract Time: No \_\_\_ Yes \_\_\_ Add/Deduct \_\_\_\_\_ days.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior to the specified product.
- Same warranty will be furnished for proposed substitution as for the specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated herein is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions, functional clearances or design appearance.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: \_\_\_\_\_

Attachments: \_\_\_\_\_

**SECTION 01 71 00  
CUTTING AND PATCHING**

**PART 1 – GENERAL****1.01 DESCRIPTION**

- A. Work Included in This Section:
  - 1. Provide all labor, materials, equipment and services, etc., required for all cutting (including excavation), removal, fitting, patching, and/or repairs as required to:
    - a. Make the several parts fit properly.
    - b. Uncover work to provide for installing, inspecting, or both, of ill-timed work.
    - c. Remove and replace work not conforming to requirements of the Contract Documents.
    - d. Remove and replace defective work.
- B. Related Work:
  - 1. In addition to other requirements noted or specified, upon the Architect's request uncover work to provide for observation by the Architect of covered work, and remove samples of installed materials for testing.
  - 2. Do not cut or alter work performed under separate contracts without the Architect's written permission.

**1.02 SUBMITTALS**

- A. Where cutting and/or patching is required, the Architect's review of proposed cutting and patching procedures is required. The following information shall be included in the submission prior to proceeding with cutting:
  - 1. Clearly describe the extent of cutting and patching required and how it is to be performed. Layout the work on-site as appropriate. Indicate why it cannot be avoided.
  - 2. Describe the anticipated results in terms of changes to existing construction. Include changes to structural elements and operating components and changes in the building's appearance and other visual elements.
  - 3. List products to be used and firms that will perform the Work. Indicate dates for cutting and patching. Submit samples of actual materials to be used for patching.
  - 4. List any utilities that will be disturbed, relocated, made temporarily out-of-service, and indicate the length of service disruption.
  - 5. Where cutting and patching involves the addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
- B. Acceptance of the cutting and patching proposal by the Architect does not waive the Architect's right to later require complete removal and replacement of Work found to be unsatisfactory, nor does it alter the Contractor's sole responsibility for the safe and proper execution of all cutting and patching.
- C. Submit written notice to the Architect designating the time the Work will be uncovered, to provide for the Architect's observation.

**1.03 QUALITY ASSURANCE**

- A. Structural Work: Do not cut and patch structural elements in a manner that would reduce their structural characteristics such as load-carrying capacity or load deflection ratio.
  - 1. Obtain approval of the cutting and patching proposal before cutting and patching structural elements, including but not necessarily limited to:
    - a. Foundation construction.
    - b. Bearing and retaining walls.
    - c. Structural concrete.
    - d. Structural steel.
    - e. Lintels.
    - f. Structural decking.
    - g. Stair systems.

- h. Miscellaneous structural metals.
  - i. Equipment supports.
  - j. Piping, ductwork, vessels, and equipment.
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety components in a manner that would reduce their capacity to perform as intended, or would increase maintenance, or decrease operational life or safety.
  - 1. Obtain approval of the cutting and patching proposal before cutting and patching operating elements or safety related systems, including but not necessarily limited to:
    - a. Shoring, bracing, and sheeting.
    - b. Primary operational systems and equipment.
    - c. Firewalls and fire separation assemblies.
    - d. Fire-rated and non-fire-rated smoke barriers.
    - e. Water, moisture, or vapor retarders.
    - f. Membranes and flashings.
    - g. Fire protection systems.
    - h. Sprayed-on Fireproofing.
    - i. Noise and vibration control elements and systems.
    - j. Control systems.
    - k. Voice, video, and data systems.
    - l. Electrical wiring systems.
- C. Remove, replace, patch and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

## **PART 2 – PRODUCTS**

### **2.01 MATERIALS**

- A. For replacement of items removed, use materials identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible. Use materials whose performance will equal or surpass that of existing materials.

### **2.02 PAYMENT FOR COSTS**

- A. Perform cutting and patching needed to comply with the Contract Documents at no additional cost to the Owner.
- B. All costs resulting from ill-timed or defective work, or work otherwise not conforming to the Contract Documents shall be borne by the Contractor.

## **PART 3 – EXECUTION**

### **3.01 SURFACE CONDITIONS**

- A. Inspection: Inspect existing conditions, including elements subject to movement or damage during cutting, excavating, patching, and backfilling.
- B. After uncovering the work, inspect conditions affecting installation of new work.
- C. Prior to proceeding, meet with all parties involved in cutting and patching including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- D. Discrepancies: If uncovered conditions are not as anticipated, immediately notify the Architect and secure needed directions. Do not proceed until unsatisfactory conditions are corrected.

**3.02 PREPARATION PRIOR TO CUTTING**

- A. Provide required protection including, but not necessarily limited to, shoring, bracing, and support to maintain structural integrity of the Work.
- B. Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Work that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas. Take all precautions to avoid cutting existing pipe, conduit, or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.
- D. Provide proper dirt, dust, fume, vapor, and noise control.
- E. Verify the conditions and requirements of all existing warranties that may be affected by cutting and patching (such as roofing warranties). It is the intent that all cutting and patching be performed in a manner that preserves all such warranties in full, without compromise.

**3.03 PERFORMANCE**

- A. General: Cutting and patching shall be kept to an absolute minimum by careful planning and through proper holes, sleeves, anchors, inserts, or other built-ins as the Work progresses.
- B. Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
- C. The Contractor shall properly restore work that has been cut or removed and install new products to provide completed work in accordance with the requirements of the Contract Documents. Existing surfaces shall be restored to their original condition.
- D. Cutting: Perform cutting and demolition by methods least likely to damage elements to be retained or adjoining construction and that will provide proper surfaces to receive installation of repair and new work. Where possible, review procedures with the original installer. Comply with the original installer's recommendations.
- E. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
- F. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
- G. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
- H. Perform necessary excavating and backfilling as required under pertinent other Sections of these Specifications.
- I. By-pass utility services such as pipe or conduit, before cutting, where services are shown, or removal required, relocated, or abandoned. Cut off pipe or conduit in walls or partitions, to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- J. Patching: Perform fitting and adjusting of products as required to provide finished installations complying with the specified tolerances and finishes or otherwise satisfactory to the Architect.
- K. Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
- L. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
- M. Where the removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.
- N. Where patching occurs in a smooth painted surface, extend final paint coat over the entire unbroken surface containing the patch, after the patched area has received primer and first coat.
- O. Patch, repair, or re-hang existing ceilings, as necessary to provide an even plane surface of uniform appearance.
- P. At penetrations in fire-resistive rated walls, partitions, ceilings, floors, or roof construction, completely seal voids with firestopping materials in compliance with Section 07 84 00 -



Firestopping.

**3.04 CLEAN-UP**

- A. All debris and rubbish shall be properly removed from the premises as it occurs. All materials shall be properly disposed of off-site, in strict accordance with all applicable Laws, Rules, Regulations, and Ordinances.
- B. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean surfaces before painting or finishing.

**END OF SECTION**

**SECTION 01 74 19  
CONSTRUCTION WASTE MANAGEMENT**

**PART 1 GENERAL**

**1.01 WASTE MANAGEMENT REQUIREMENTS**

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
  - 1. Aluminum, glass and plastic beverage containers.
  - 2. Corrugated cardboard.
  - 3. Wood pallets.
  - 4. Clean dimensional wood .
  - 5. Land clearing debris, including brush, branches, logs, and stumps; see Section 31 10 00 - Site Clearing for use options.
  - 6. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
  - 7. Acoustical ceiling tile and panels.
- E. Demolition debris shall be sent to a certified recycling facility for sorting to recycle, reuse and remainder to landfill. It is expected that at least 75% of loads shall be diverted from landfills.
- F. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.
- G. 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-site or off-site.
- H. 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 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.

### **1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Submit Waste Management Plan within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.
- C. Waste Management Plan: Include the following information:
  - 1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
  - 2. 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 landfill disposal of all non-recycled project trash/waste.
  - 3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
    - a. List the local market for each material.
  - 4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
  - 5. Designation of the party who will be responsible for implementing the plan.
- D. Monthly Reports: The certified recycling facility shall submit monthly reports of all project demolition debris and construction waste removed, recycled and landfilled. The report shall include:
  - 1. Date, disposal ticket #, materials type, total weight of the load, weight of material recycled from the load, % of materials recycled, materials destinations, tipping fees and disposal cost.

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

## **PART 3 EXECUTION**

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

- A. Manager: Designate a person who will be responsible for implementing the plan, instructing workers, coordinating waste materials handling, any on-site separation requirements for all trades and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site superintendent, each subcontractor, Owner, and Architect.
- C. Facilities: Provide specific facilities for on-site containment and transportation of demolition debris and construction waste materials to off-site recycling and disposal facility for use by all contractors and installers
  - 1. Provide containers as required.
  - 2. Provide adequate space for pick-up and delivery of containers.
  - 3. Keep trash/waste bin areas neat and clean.
- D. Do not handle, separate, store, salvage, or recycle hazardous materials. Contact Owner if hazardous materials are encountered.

**END OF SECTION**

**SECTION 01 78 00  
PROJECT CLOSE-OUT**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Substantial Completion procedures.
  - 1. Project Close-out meeting.
  - 2. Occupancy Permit.
- B. Project Record Documents.
  - 1. Record Drawings.
  - 2. List of Subcontractors and material suppliers.
  - 3. Operation and Maintenance Data.
  - 4. Warranties and bonds.
  - 5. Contractor's Certificate of No Hazardous Materials.
  - 6. Testing Agency Final Report.
  - 7. Air-Quality Final Report.
- C. Architect's evaluation of the Work.
- D. Final Acceptance procedures.
- E. Operating and Maintenance Instructional Sessions.
- F. Adjustments.
- G. Final Cleaning.

**1.2 RELATED REQUIREMENTS**

- A. Section 00 72 00 - General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
- B. Section 01 00 00 - General Requirements.
- C. Section 01 00 30 - Electronic Media: Record Drawing backgrounds.
- D. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- E. Section 01 40 00 - Quality Services: Final Test Reports.
- F. Section 01 78 10 - Warranties: General warranty requirements.
- G. Individual Product Sections: Specific requirements for operation and maintenance data.
- H. Individual Product Sections: Warranties required for specific products or Work.

**1.3 SUBSTANTIAL COMPLETION PRELIMINARY PROCEDURES**

- A. Prior to requesting evaluation of the Work for certification of Substantial Completion, the Contractor shall complete the following items.
- B. Close-out Meeting: Not less than thirty (30) days prior to the anticipated date of Substantial Completion, the Contractor shall conduct a Project close-out meeting. Participants in the meeting shall include the Contractor, subcontractors, , Owner and Architect. The Contractor shall prepare the agenda and schedule of close-out tasks, for prior distribution, which, among other items as may be determined by the Contractor, shall include the following:
  - 1. HVAC Start-up Activities.
  - 2. Programming of Energy Management System
  - 3. Indoor Air Quality Testing (as applicable)
  - 4. Testing and Inspections with Authorities Having Jurisdiction:
    - a. Fire alarm system test
    - b. Sprinkler system testing
    - c. Certificate of Occupancy inspection
  - 5. Other Testing.
    - a. Security system
  - 6. Owner's Equipment Testing.
    - a. Telephone equipment
    - b. Computer network equipment
    - c. Audio-visual equipment

7. Delivery of tools, spare parts, extra stock, etc.
8. Punch Lists:
  - a. Contractor
  - b. Architect / Owner
9. Final Cleaning Operations.
10. Transition Security Issues.
  - a. Removal of construction trailers, fencing, gates, etc.
  - b. Door key change-over
11. Transition Issues.
  - a. Insurance change-over.
  - b. Owner's schedule for move-in of furnishings and equipment
12. Instructional Sessions:
  - a. Mechanical, sprinkler and electrical systems.
13. Record Information:
  - a. Warranty binder
  - b. Record Drawings
  - c. O&M manuals
14. Close-out Paperwork:
  - a. Release of Liens
  - b. Consent of Surety
  - c. Certification of No Hazardous Materials
  - d. Testing Agency Final Report
  - e. Air Quality Certification
- C. Adjust Contract Amount by Change Order to assess Owner for additional cost or savings due to increase or decrease in:
  1. Savings accrued under the Guaranteed Maximum Price.
- D. Contractor's Punch List: Prior to preparation of a punch list by the Owner and Architect, the Contractor shall prepare his own comprehensive punch list, and along with his subcontractors, properly complete all Work items thereon. The receipt of the Contractor's written punch list, clearly identifying all completed and pending items, shall be considered a prerequisite for the commencement of the Owner and Architect's evaluation of the Work for Substantial Completion.
- E. Advise Owner of pending insurance and utility change-over requirements.
- F. Submit warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
- G. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities, including Occupancy Permits, operating certificates and similar releases. If the Project is completed in phases, obtain Occupancy Permits as required by governing authorities.
- H. Deliver tools, spare parts, extra stock, and similar items.
- I. Make final change-over for locks, keys, and other security provisions.
- J. Complete start-up testing of equipment and systems, conduct Owner's training sessions.
- K. Discontinue, change over and remove temporary facilities from the site. Remove temporary protection measures provided during construction.
- L. Final Cleaning.
- M. Certificate of Occupancy: The Contractor shall schedule various inspections with the Authority Having Jurisdiction as required to obtain a Certificate of Occupancy.

#### 1.4 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
  1. Record Drawings: Shall be required for all Site Utilities, Site Drainage, Architecture, Building Structure, Mechanical Systems, Fire Protection Systems and Electrical Systems.
    - a. The Contractor shall maintain one set of Contract Drawings for use in the preparation of Record Drawings. This set shall be maintained at the site, and upon them, the Contractor shall clearly and accurately record all Addenda, Supplementary

- Instructions, Change Orders, Architect's responses to Contractor's Requests for Information, and all significant changes made during construction to the Work hereinafter listed.
- b. Upon completion of the Contract, and as a prerequisite to final Payment, the Contractor shall prepare (draft as necessary), check, and certify the Record Drawings for completeness and accuracy and submit them to the Architect. The Contractor's submittal shall include one set of CD Rom electronic media files and one set blackline hard copy Record Drawings. The Contractor shall imprint the following text on each Record Drawing and Record Drawing Electronic Media File:
    - 1) NOTE: This drawing has been produced by (name and address of contractor). It is not the originally designed Contract Document. It is a Record Drawing."
    - 2) See Section 01 00 30 - Electronic Media for information regarding obtaining electronic Contract Documents for use in preparing for Record Drawings.
  - c. The Architect will casually review such drawings, but will in no way ascertain or certify their completeness or correctness, which shall remain the sole responsibility of the Contractor. The Architect shall be entitled to rely upon the thoroughness and accuracy of the Contractor's documents, without further verification. Following his review, the Architect will forward all Record Drawings to the Owner for his use.
2. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Complete miscellaneous records, place in good order, properly identified and bound ready for reference and submit to the Architect for the Owner's records.
  3. List of Subcontractors: The Contractor shall submit to the Architect two (2) typed updated lists of all subcontractors, service organizations, and principal vendors, including names, addresses, and telephone numbers where they can be reached for emergency service at all times including nights, weekends, and holidays.
- B. Operation and Maintenance Data:
1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
  2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
  3. 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.
  4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
1. The Contractor shall submit to the Architect two (2) typed sets, neatly bound and indexed in a loose leaf binder, of all warranties, certificates and bonds as required by the Contract Documents.
  2. For equipment or component parts of equipment put into service during construction with Owner's permission, submit a copy of documents within 10 days after acceptance.
  3. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
  4. 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. Pages shall be pre-punched for insertion into the bound set.

## 1.5 ARCHITECT'S EVALUATION

- A. On receipt of a written request from the Contractor, the Architect will either proceed with evaluation of the Work for Substantial Completion or advise the Contractor of requirements yet to be completed prior to evaluation.
- B. Based on his/her observations, the Architect will provide a written list, or "Punch List", of items to be corrected or to be completed. The Architect's list may not include all Work necessary for completion in accordance with the Contract Documents and shall not in any way relieve the

Contractor of responsibility for compliance with the Contract Documents.

- C. The Architect shall prepare the AIA G704 Certificate of Substantial Completion form and attach his/her written evaluation list thereto.
- D. Additional Work found to be incomplete or not in conformance with the Contract Documents after the Architect's evaluation shall be completed or corrected before Final Acceptance and Final Payment.
- E. When Work has been completed or corrected, the Contractor shall submit to the Architect a written request for re-evaluation. Include a copy of the Architect's previous evaluation report with notation of action taken for each item.

#### **1.6 FINAL ACCEPTANCE**

- A. Within five (5) working days after the date of Substantial Completion, the Contractor shall provide a list of final Contract requirements with anticipated completion dates including:
  - 1. List of incomplete Work.
  - 2. Final Change Orders.
  - 3. Consent of Surety to final payment
  - 4. Assurances that unsettled claims will be settled.
  - 5. Record Drawings, O& M Manuals, Final Project Photos, Damage or Settlement Survey or other final record information.
  - 6. Final Application for Payment with releases and supporting documentation, including final waivers of lien.
  - 7. Written confirmation that corrective work related to any failed quality control testing has been provided, and that satisfactory retesting has been performed and approved by the testing agency.
- B. Re-evaluation Procedure: The Architect will re-evaluate the Work upon receipt of written notice from the Contractor that the Work, including correction of items previously noted, has been completed.
  - 1. Upon completion of re-evaluation, the Architect will prepare a Certificate of Final Acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for Final Acceptance.
  - 2. If necessary, re-evaluation for Final Acceptance will be repeated. Cost of re-evaluation will be the responsibility of the Contractor.

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

### **PART 3 EXECUTION**

#### **3.1 INDOOR AIR QUALITY MANAGEMENT**

- A. The Contractor and his various subcontractors as he may direct shall implement the procedures throughout construction in an effort to improve indoor air quality during the Owner's occupancy. See 01 57 21 - Indoor Air Quality Controls.

#### **3.2 PROJECT RECORD DOCUMENTS**

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
  - 1. Drawings.
  - 2. Specifications.
  - 3. Addenda.
  - 4. 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. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
  - 1. Changes made by Addenda and modifications.
- F. Record Drawings : Legibly mark each item to record actual construction including:
  - 1. Measured depths of foundations in relation to finish first floor datum.
  - 2. Measured horizontal and vertical locations of underground utilities and appurtenances,

- referenced to permanent surface improvements.
- 3. Field changes of dimension and detail.
- 4. Details not on original Contract drawings.

### **3.3 OPERATION AND MAINTENANCE DATA**

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. 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.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

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

- A. For Each Product, Applied Material, and Finish:
  - 1. Product data, with catalog number, size, composition, and color and texture designations.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Additional information as specified in individual product specification sections.
- D. 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.

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

- A. For Each Item of Equipment and Each System:
  - 1. Description of unit or system, and component parts.
  - 2. Identify function, normal operating characteristics, and limiting conditions.
  - 3. Include performance curves, with engineering data and tests.
  - 4. Complete nomenclature and model number of replaceable parts.
- B. 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.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- F. Provide servicing and lubrication schedule, and list of lubricants required.
- G. Include manufacturer's printed operation and maintenance instructions.
- H. Include sequence of operation by controls manufacturer.
- I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- J. Provide control diagrams by controls manufacturer as installed.
- K. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- L. Include test and balancing reports.
- M. Additional Requirements: As specified in individual product specification sections.

### **3.6 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. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
  - D. Prepare data in the form of an instructional manual.
  - E. 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.
  - F. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
  - G. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
  - H. 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.
  - I. 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.
  - J. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
  - K. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages, house in plastic sleeves.
  - L. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
  - M. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
    - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
    - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      - a. Significant design criteria.
      - b. List of equipment.
      - c. Parts list for each component.
      - d. Operating instructions.
      - e. Maintenance instructions for equipment and systems.
      - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
    - 3. Part 3: Project documents and certificates, including the following:
      - a. Shop drawings and product data.
      - b. Air and water balance reports.
      - c. Certificates.

### **3.7 SPARE PARTS AND MAINTENANCE PRODUCTS**

- A. Provide spare parts, maintenance, and extra products in quantities as specified in individual Specification Sections. Deliver to the site and place in locations as directed by the Owner. Obtain receipts signed by Owner's Representative and submit copies to the Architect if so directed.

### **3.8 WARRANTIES AND BONDS**

- A. See Section 01 78 10 : Warranties, for additional information.
- B. Retain warranties and bonds until time specified for submittal.
- C. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
- D. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and

- name of responsible company principal.
- E. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
  - F. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

### **3.9 CERTIFICATE OF NO ASBESTOS**

- A. See Section 01 30 00 - Administrative Requirements, for requirements for submission of Certificate(s) of No Asbestos.

### **3.10 FINAL TESTING REPORTS**

- A. See Section 01 40 00 - Quality Services, for requirements for the Testing Agency's Final Report.

### **3.11 OPERATING AND MAINTENANCE INSTRUCTIONS / OWNER TRAINING**

- A. Instructions: The Contractor and his subcontractors and suppliers shall jointly, thoroughly instruct the Owner's representative and maintenance personnel in the proper maintenance and operation of all materials and systems that require training for proper operation and/or regular maintenance as follows:
  - 1. Demonstrated and written detailed instructions shall be provided and reviewed for materials and systems listed in Substantial Completion Preliminary Procedures paragraph of this Section, shall include, but not be limited to:
    - a. Start-up and Shut-down procedures.
    - b. Emergency operations.
    - c. Noise and vibration adjustments.
    - d. Control sequences.
    - e. Trouble-shooting.
    - f. Safety procedures.
    - g. Maintenance manuals.
    - h. Maintenance agreements.
    - i. Warranties.
    - j. Record Drawings.
    - k. Tools, spare parts, lubricants.
    - l. Cleaning, economy and efficiency adjustments.
    - m. Fuels, and fuel conversion, if applicable.
    - n. Identification systems.
    - o. Hazards. Any operations that, if improperly performed, might endanger the building's occupants or damage the building's equipment or contents.
  - 2. Video all demonstrations of operation and maintenance sessions, which shall be held at the completed facility to instruct the Owner in the proper operation of equipment and systems. Prior to final payment, deliver two (2) copies to the Architect for forwarding to the Owner.
  - 3. The Contractor shall obtain sign-off from the Owner for meeting with each installer or manufacturer's representative.
  - 4. For equipment or systems requiring seasonal operation perform demonstrations for the other season within six (6) months.

### **3.12 ADJUSTING**

- A. Adjust operating products and equipment to ensure smooth and unhindered operation. For testing, adjusting and balancing of HVAC systems see Division 25 - Mechanical.

### **3.13 FINAL CLEANING**

- A. Final Cleaning: Upon the completion of the Work, the Contractor shall remove all tools,

scaffolding, surplus materials, debris, and shall leave the Work "broom clean" or its equivalent. In addition to general broom cleaning, the Contractor shall employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Use products that are non-hazardous. Cleaning shall be in compliance with requirements of Section 01 73 40 - Indoor Air Quality and with all manufacturer's written instructions. The following cleaning shall be done just before inspection for certification of Substantial Completion and final acceptance of the Work:

1. Transparent Materials: Clean mirrors and glazing in doors and windows; remove paint and glazing compounds that are noticeably vision obscuring; wash and polish, taking care not to scratch materials. Replace chipped, scratched, or broken materials.
2. Ceiling and Wall Surfaces: Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, marks, fingerprints, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Carefully clean (vacuum) fabric type surfaces as recommended by manufacturer. Generally clean as required to leave in first class condition.
3. Flooring: Remove all temporary protection; remove all spots, soil and paint; and clean, shampoo, wax, and buff, etc. all ceramic tile, resilient flooring, base, and other floors in accordance with manufacturer's recommendations. Leave concrete floors broom clean. Vacuum carpeted surfaces.
4. Hardware: Clean and polish all hardware for all trades; this shall include removal of all paint stains, dust, dirt, etc.
5. All fixtures, equipment, doors, and door and window frames: Clean all surfaces per manufacturer's instructions, removing all stains, paint, dirt and dust.
6. Labels: Remove all labels that are not permanent.
7. Mechanical and Electrical Equipment: Wipe surfaces of equipment to be free of paint, dirt, and dust. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps. Replace burned-out lamps.
8. Roofs: Clean debris from roofs, scuppers, and drainage systems.
9. Site: Clean the building site and surrounding ground. All trash and rubbish shall be removed and properly disposed of off-site and in accordance with Section 01 74 19 Construction Waste Management. Sweep paved areas broom clean and remove stains and spills. Rake disturbed grounds that are neither paved nor planted, to a smooth even-textured surface.

#### **END OF SECTION**

**SECTION 01 78 10  
WARRANTIES****PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Administrative and procedural requirements for warranties.

**1.2 RELATED SECTIONS**

- A. Section 01 00 00 - General Requirements.
- B. Section 01 78 00 - Project Close-out.
- C. Divisions 2 through 28 for specific Section requirements.

**1.3 GENERAL**

- A. Manufacturers' disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.
- B. "Standard Product Warranties" are preprinted written warranties published by individual manufacturers of particular products and are specifically endorsed by the manufacturer to the Owner.
- C. "Special Warranties" are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

**1.4 WARRANTY REQUIREMENTS**

- A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and has been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
- D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
  - 1. The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- E. Owner's Right of Refusal: The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.
- F. Commencement Date of Warranties: The Date of Substantial Completion designates the commencement date for warranties unless specifically indicated otherwise.
  - 1. Commencement of warranties for items not accepted shall not begin until after items have been accepted.

**1.5 SUBMITTALS**

- A. Submit written warranties and bonds to the Architect in conformance with Section 01 78 00 - Project Close-out.

- B. When a special warranty is required from the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Architect for review by the Owner prior to final execution.
- C. Form of Submittal: At Final Completion, compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer.
  - 1. Verify the documents are in proper form, contain full information, and are notarized. Co-execute warranties when required.

#### **1.6 SCHEDULE OF GUARANTEES, WARRANTIES, AND BONDS**

- A. Guarantee: The Contractor shall guarantee the entire Work to be free from defective or improper work or materials, and shall make good any damage due to such work or materials for a term of one year from the date of the satisfactory completion and acceptance of the Work. In general the commencement date for warranties and guarantees shall be the date of Substantial Completion. Under no circumstances shall any warranties or guarantees for any individual or collective materials or items of equipment commence prior to the date of Substantial Completion. Extended guarantees or warranties shall be provided as specified elsewhere.
- B. Provide guarantees, warranties, and bonds on products and installations as specified in individual Sections.

**END OF SECTION**

## SECTION 02 00 00 INTRODUCTION TO SITEWORK

### PART 1.0 - GENERAL

#### 1.01 SPECIFICATIONS

- A. All sitework included or ordered under this contract shall be done in conformity with the applicable provisions of the State of New Hampshire Department of Transportation's "Standard Specifications for Road and Bridge Construction" latest revision including all the latest addenda, and supplements, henceforth referred to as "Standard Specifications. Work shall also be done in conformity with the City of Portsmouth rules, regulations, codes, ordinances and specifications; and utility company specifications.
- B. Division 1 - "General Provisions of the State of New Hampshire Specifications for Road and Bridge Construction", latest revised including all the latest revisions will not apply to this project except as follows:
  - 1. When any of the Technical Specifications of Division 2 through 7 reference Division 1.
  - 2. Definition: Wherever the word "Engineer" is referred to in the Standard Specifications, it shall mean AECm, LLC. and its authorized representatives.
  - 3. Definition: Wherever the word "Department" or "Commissioner" is referred to in the Standard Specifications, it shall mean the City of Portsmouth and its authorized representatives.
- C. Measurement and Payment Section of the Standard Specifications are not applicable because all work is to be completed on a lump sum basis.
- D. Titles to divisions and paragraphs in these specifications and in the notes on the drawings are introduced for convenience and shall not be taken as an exact or complete segregation of materials and labor.
- E. In addition to the "Standard Specifications" the work shall be completed in conformance with the Supplemental Specifications consisting of sections:

Section 02 00 00 -	Introduction to Sitework
Section 02 01 00 -	Subsurface Explorations
Section 02 05 00 -	Demolition
Section 02 06 00 -	Building Demolition
Section 02 10 00 -	Clearing, Grubbing & Stripping
Section 02 12 10 -	Environmental Protection
Section 02 20 10 -	Building Pad Earthwork
Section 02 20 20 -	Site Earthwork
Section 02 21 80 -	Earth Trench Excavation & Backfill
Section 02 27 00 -	Erosion Control
Section 02 50 00 -	Paving, Curbs & Walks
Section 02 50 10 -	Reclaimed Stabilized Material
Section 02 51 00 -	Bituminous Pavement Sawcut & Patch
Section 02 55 00 -	Pavement Striping
Section 02 64 90 -	Plantings
Section 02 66 00 -	Water Supply
Section 02 70 00 -	Sanitary Sewer
Section 02 75 00 -	Storm Drainage
Section 02 93 00 -	Loaming and Seeding

- F. If conflicts arise between any of these specifications, the most stringent specifications shall govern.
- G. Latest revision of federal, state and ASTM Specifications shall be used where only the specification number without date or revision number is given in the specification.
- H. The omissions from the plans and/or specifications of express reference to any labor or materials reasonably to be inferred therefrom and necessary for the proper execution of the work shall not relieve the Contractor or Subcontractor from furnishing them of a kind in keeping with the general character of the work.

- I. The Owner's Representative shall decide all questions which may arise as to the quality, quantity, acceptability, fitness and rate of progress of the several kinds of work and materials to be performed and furnished under the contract, and shall decide all questions which may arise as to the fulfillment of the contract on the part of the Sitework Contractor. The Owner's Representative's determination and decision shall be final and conclusive.

#### **1.02 PROJECT CONDITIONS**

- A. It was not possible for the Owner, and/or Engineer to observe all existing conditions in the completion of these documents. Unforeseen conditions are expected to be discovered. The accuracy of the existing conditions data is not guaranteed to the Contractor. During the execution of the work it shall be the Contractor's responsibility to discover, identify, and observe existing conditions not anticipated by the Construction Documents, and promptly notify the Owner's Representative of such conditions and proposed solutions at no additional cost. The Contractor's bid shall anticipate delays associated with conflicts with existing utilities.

#### **1.03 SUMMARY OF SITEWORK**

- A. The following list is provided to generally describe the sitework and is not intended to be a full and definitive project description. The work is more fully described in the plans and specifications.
  1. Layout/As-Built
    - a. Layout all lines and grades. (Owner to provide benchmark), edge of pavement and radii coordinates and traverse coordinates.
    - b. Provide As-Built Plans off all completed sitework stamped by a licensed New Hampshire land surveyor at completion of work.
  2. Demolition
    - a. Remove all trees, shrubs, brush and plantings within limits of work unless specifically identified to remain.
    - b. Grub and remove all stumps within limits of work and dispose of off-site in accordance with all laws and regulations.
    - c. Sawcut and remove existing pavement one foot off proposed edge of pavement in all areas where new curb or pavement abuts existing pavement or concrete to remain.
    - d. Remove and dispose of all site elements not incorporated into the work within the areas to be disturbed (concrete pads, curbing, pavement, catchbasins, backboards, pads, signs, fences, utilities, etc.).
    - e. Remove and provide for off-site disposal of construction debris piles.
  3. Erosion Control
    - a. Furnish and install silt fence and hay bales and other erosion control measures where shown.
    - b. Inspect and maintain erosion control devices at least once each week and following any storm event of 1/2 inch or greater.
    - c. Provide water truck for dust control and use other dust control agents where applicable.
    - d. Furnish and install stabilized construction entrances prior to any excavation activities.
    - e. Provide for street sweeping of offsite roadways during heavy haul periods.
    - f. Provide temporary stabilization of disturbed areas left inactive for more than twenty-one (21) days.
    - g. Provide for inspection reports of erosion control items.
  4. Earthwork
    - a. Strip and stockpile topsoil to be reused on site. All excess topsoil stripped from the site shall become property of the Contractor, and shall be legally disposed of offsite by the Contractor.
    - b. Complete earthwork to subgrade for remaining site. All excess material shall become property of the Contractor, and shall be legally disposed of offsite by the Contractor.
    - c. Dewatering, including removal of unstable natural subgrade soils and replacement with crushed stone if necessary.
    - d. Prepare subgrade, backfill or import fill as required by plans and specifications.
  5. Utilities
    - a. Provide site lighting.

6. Drainage
  - a. Furnish and install all drainage pipe and structures as shown, including manholes, catchbasins and drains.
7. Landscaping
  - a. Furnish and install screened loam on site as indicated on the drawings.
  - b. Fertilize and seed lawn areas and mulch other areas.
  - c. Maintain lawn areas until healthy turf is established and accepted by the Owner's Representative.
  - d. Furnish and install trees
  - e. Provide one (1) year warranty on all seeding.
8. Pavement
  - a. Reclaim existing pavement and remove additional materials.
  - b. Furnish and install granular base and subbase where indicated on plans for new pavement area.
  - c. Compact and fine grade granular base and subbase.
  - d. Sawcut all edges of pavement where new pavement abuts existing.
  - e. Provide and place pavement binder and wearing courses per pavement sections.
9. Site Appurtenances
  - a. Furnish and install pavement markings for all parking stalls, handicap spaces, fire lanes, etc. as indicated on the drawings.
  - b. Furnish and install signs as indicated on the drawings.
10. Traffic Control
  - a. Provide temporary barriers, signs, illumination devices, flag personnel and uniformed officers as necessary for traffic control.
11. Permits
  - a. The contractor shall obtain all utility installation licenses and permits, roadway trenching permits, miscellaneous construction permits.
  - b. Coordinate inspection with local authorities and utilities.
12. Final cleanup
  - a. Clean all manholes, catchbasins and drain lines (new and existing).
  - b. Remove all litter and trash.
  - c. Sweep parking lot immediately prior to leaving site.
13. General Conditions
  - a. Provide full-time on-site Superintendent.
  - b. Coordinate work and cooperate with abutters.

**END OF SECTION**



**SECTION 02 05 00  
DEMOLITION****PART 1.0 - GENERAL****1.01 DESCRIPTION**

- A. Work Included:
  - 1. The Contractor shall furnish all labor, materials, tools, equipment and apparatus necessary and shall do all work required to complete the demolition, removal and alterations of existing facilities as indicated on the Drawings, as herein specified, and/or as directed by the Engineer. The work in general includes the demolition and legal disposal of materials shown to be removed on the drawings and as required for new construction.
  - 2. All equipment, piping and other materials that are not to be relocated or to be returned to the Owner shall become the property of the Contractor and shall be disposed of by him, away from the site of the work and at his own expense.
  - 3. All demolition or removal of existing structures, utilities, equipment and appurtenances shall be accomplished without damaging the integrity of existing structures, equipment and appurtenances to remain, to be salvaged for relocation or stored for future use.
  - 4. Such items that are damaged shall be either repaired or replaced at the Contractor's expense to a condition at least equal to that which existed prior to the start of work.
- B. Related Work Specified Elsewhere: (When Applicable)
  - 1. Section 02 10 00 – Clearing, Grubbing and Stripping
  - 2. Section 02 20 00 – Earthwork

**1.02 JOB CONDITIONS**

- A. Condition of Structures:
  - 1. The contractor shall inspect the premises prior to submittal of his proposal for verification of existing conditions which will affect his work.
  - 2. The owner assumes no responsibility for the actual condition of structures to be demolished or abandoned.
  - 3. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner as far as practicable.

**1.03 UTILITIES**

- A. Utility Locations:
  - 1. Utility locations shown on the plans are approximate only, based on information supplied by the Owner.
- B. Coordination with Utilities:
  - 1. The Contractor shall make all necessary arrangements and perform any necessary work to the satisfaction of affected utility companies and government divisions involved with the discontinuance or interruption of affected public utilities and services.

**1.04 SUBMITTALS**

- A. Schedule – Demolition:
  - 1. Submit two (2) copies of proposed methods and operations of demolition to the Engineer for review prior to the start of work. Include in the schedule the coordination for shut-off, capping and continuation of utility services as required.
  - 2. Provide a detailed sequence of demolition and removal work to ensure the uninterrupted progress of the Owner's operations.

**1.05 PROTECTIONS**

- A. Ensure the safe passage of persons around the area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities and persons. Erect temporary, covered passageways as required by authorities having jurisdiction.
- B. Provide interior and exterior shoring, bracing or support to prevent movement, settlement or

collapse of structures to be demolished and adjacent facilities to remain.

**1.06 DAMAGES**

- A. The Contractor shall promptly repair damages caused by demolition operations to adjacent facilities at no cost to the Owner.

**1.07 PERMITS**

- A. The contractor shall obtain all permits required by local, state and federal governing authorities for removal and disposal of all demolition materials.

**PART 2.0 - PRODUCTS**

Not Applicable.

**PART 3.0 - GENERAL****3.01 PERFORMANCE**

- A. Remove and dispose of non-salvageable material in accordance with all applicable local and state laws, ordinances and code requirements.
- B. Dispose of material daily as it accumulates. Any demolition materials that are temporarily stored on site will not be stored in piles on the ground. These materials will be temporarily stored in dumpsters provided by the contractor while awaiting offsite disposal.
- C. Carefully remove, store and protect from damage all materials to be salvaged
- D. Burning of materials will not be permitted on the site.
- E. Buildings and Adjacent Property:
  - 1. Protect all buildings and property adjacent to equipment to be removed from damage by erecting suitable barriers or by other suitable means.
  - 2. Leave such buildings in a permanently safe and satisfactory condition.
- F. Maintaining Traffic
  - 1. Ensure minimum interference with roads, streets, driveways, sidewalks and adjacent facilities.
  - 2. Do not close or obstruct street, sidewalks, alleys or passageways without permission from authorities having jurisdiction.

**3.02 POLLUTION CONTROL:**

- A. Use water, sprinkling, temporary enclosures and other suitable methods to limit dust and rising and scattering in air to the lowest level possible. Comply with governing regulations pertaining to environmental protection.

**3.03 SALVAGED MATERIAL SCHEDULE:**

- A. Remove, salvage and store the following materials:
  - 1. Catchbasin and manhole castings
  - 2. Granite Curb
  - 3. Jersey Barriers
  - 4. Any other items the Owner may identify at time of construction

**END OF SECTION**

**SECTION 02 06 00  
BUILDING DEMOLITION**

**PART 1.0 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Demolition of designated structures and contents and removal of materials from site.
- B. Demolition and removal of all concrete including foundations, footings and slabs on grade.
- C. Identifying, disconnecting and removal of all utility services to the utility main.
- D. Prepare and file all necessary permit applications for demolition and utility removal.

**1.02 JOB CONDITIONS**

- A. The contractor shall inspect the premises, prior to submittal of proposal, for verification of existing conditions, which will affect this work.
- B. Promptly repair damages caused to adjacent facilities by demolition operations, as directed by the Owner's Representative and at no cost to the Owner.
- C. The Owner assumes no responsibility for the actual condition of the structures or utilities.

**1.03 DISPOSAL OF DEMOLISHED MATERIALS**

- A. At regular intervals, remove from the site all debris, rubbish, and other materials resulting from demolition operations and legally dispose of off the site. Storage or sale of demolished materials to be removed will not be permitted on the site.

**1.04 QUALIFICATIONS**

- A. Demolition Firm: Company specializing in performing the work of this section with minimum five (5) years documented experience.

**1.05 REGULATORY REQUIREMENTS**

- A. Conform to local jurisdiction having authority requirements for demolition of structures, safety of adjacent structures, dust control, runoff control, and disposal.
- B. Obtain required permits from authorities and provide copies to Owner and Owner's Representative prior to start of work.
- C. Notify affected utility companies before starting work and comply with their requirements. Provide Owner's Representative with copy of all notices.
- D. Do not close or obstruct roadways, sidewalks, or hydrants without permits.
- E. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials and notify Owner immediately.

**PART 2.0 – PRODUCTS**

NO PRODUCTS

**PART 3.0 - EXECUTION**

**3.01 PREPARATION**

- A. Provide, erect and maintain temporary barriers and security devices at locations approved by Owner's Representative or required by other authorities.
- B. Protect existing landscaping materials, appurtenances, structures, which are not to be demolished.
- C. Prevent movement or settlement of adjacent building foundations, sidewalks, pavements and utilities to remain. Provide bracing and shoring.
- D. Identify and mark location of all utilities.

**3.02 DEMOLITION REQUIREMENTS**

- A. The contractor shall use water sprinkling, temporary enclosures, and other suitable methods as necessary to limit the amount of dust and dirt rising and scattering in the air, to the lowest level of

BUILDING DEMOLITION

SECTION 02 06 00 - 1

air pollution practical for the condition of work. The contractor shall comply with all governing regulations.

**END OF SECTION**

**SECTION 02 10 00  
CLEARING, GRUBBING AND STRIPPING**

**PART 1.0 - GENERAL**

**1.01 REFERENCES**

- A. Refer to other divisions of these specifications, other sections in this division, and drawings for related work, which may affect the work of this section.
- B. The Contract Drawings indicate and show limits of construction for this project. These specifications specify material and work requirements for this project. Both are complimentary to each other, and both shall be followed to properly complete the work.

**1.02 SCOPE OF WORK**

- A. The work of this section consists of all necessary clearing, grubbing and stripping to properly allow for construction and completion of the work, all as specified herein, and as indicated on the drawings. The Contractor shall clear and grub the site within the limit of work as shown on the drawings, except for any trees, which may be designated to remain by the Owner's Representative.
- B. The Contractor shall not cut or injure any trees or other vegetation outside the construction areas without permission from owner or other jurisdictional authority and he shall guard against like action by his employees and subcontractors. Such existing trees and vegetation shall be retained and protected during construction.
- C. Prior to commencing work, all temporary erosion and pollution control devices shall be installed at locations shown on the plans or as ordered.

**1.03 RELATED WORK IN OTHER SECTIONS**

- A. The following related work is specified and included in other sections of this Specification.
  - 1. Section 02 12 10 - Environmental Protection.
  - 2. Section 02 20 20 - Site Earthwork.
  - 3. Section 02 54 00 - Erosion Control.

**PART 2.0 – MATERIALS**

NOT APPLICABLE.

**PART 3.0 - EXECUTION**

**3.01 CLEARING AND GRUBBING**

- A. The Contractor shall cut and remove all trees, shrubs, saplings, brush, stumps, vines and other debris and rubbish from the project area where noted on the drawings. The Contractor shall take care not to damage major root systems of trees and shrubs to remain during grading operations.
- B. The Contractor shall be responsible for all trees and shrubs affected by his work. If within one (1) year of the acceptance of the project, any tree affected by his work dies, the Contractor shall replace it with a tree of equal value as determined by the Owner's Representative.
- C. If sufficient quantities of material are available on-site, a chipper may be used for branches, limbs, etc. obtained during clearing, to produce woodchips. The chips shall be the property of the Contractor and shall be removed from the site by the Contractor.

**3.02 STRIPPING TOPSOIL AND UNSUITABLE MATERIAL**

- A. As necessary to properly complete the work, and in areas to be excavated, all stumps, roots, foreign matter and unsuitable earth shall be stripped from the ground surface. Topsoil and loam which is deemed suitable by the Owner's Representative shall be stockpiled and used, where possible, for finished surfacing and to construct earth beams and graded mounds.

- B. Excess topsoil is the property of the Contractor and shall be legally disposed of off-site.
- C. Unsuitable earth, stumps, roots and foreign matter shall be legally disposed of off-site by the Contractor.

**3.03 DISPOSAL OF CLEARED AND GRUBBED MATERIALS**

- A. All cleared and grubbed unsuitable materials unless otherwise noted shall become the property of the Contractor and shall be removed from the site and disposed of in compliance with federal, state and local laws and regulations.

**3.04 CLEANING UP**

- A. During construction, the Contractor shall maintain the project site and adjacent areas clean and free of all rubbish, debris, surplus materials and unnecessary construction equipment.
- B. Where material or debris has washed, flowed or in any way accumulated in watercourses, ditches, gutters, drains, pipes or structures during the course of the Contractor's operations, such material or debris shall be entirely removed and satisfactorily disposed of as necessary, and upon completion of the work shall be cleaned, flushed and left in neat conditions to the satisfaction of the Owner's Representative.
- C. The Contractor shall restore or replace, when and as directed, any public or private property damaged by his work, equipment or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. All drainage structures, curbstones, signs, guardrails, fences and stone walls which are removed or damaged as a result of the work under this contract shall be reset or replaced as required at no additional cost to the Owner.

**END OF SECTION**

**SECTION 02 12 10  
ENVIRONMENTAL PROTECTION**

**PART 1.0 - GENERAL****1.01 DESCRIPTION**

- A. Work included in this section:
  - 1. Minimize the potential adverse environmental impacts associated with construction activity.
- B. Related work specified elsewhere:
  - 1. Section 02100 - Clearing, Grubbing and Stripping
  - 2. Section 02540 - Erosion Control

**1.02 DEFINITIONS**

- A. Critical Environmental Areas: Those areas, conditions, or features which, when disturbed by construction activities, create an adverse environmental impact. Such areas include, but are not necessarily limited to, densely wooded areas, wetland areas, stream crossings, and steep slopes.

**1.03 ACCIDENT PREVENTION MEASURES**

- A. Preventative measures shall be taken to avoid spillage of petroleum products and other pollutants. The Contractor shall maintain contingency action plans for prompt remedial action in the event such spillage should occur.
- B. Every reasonable precaution shall be taken to prevent the possibility of accidentally starting fires. Construction programs shall include fire prevention planning, training of personnel in fire fighting, and a fire prevention inspection program.

**PART 2.0 - PRODUCTS****2.01 MATERIALS**

- A. Materials used for maintenance and protection of the environment shall conform to the material requirements set forth in the relevant sections of the specifications (i.e., riprap, topsoil, seeding, etc.). Unspecified materials shall be provided as selected by the Contractor, subject to the approval of the Owner's Representative.

**PART 3.0 - EXECUTION****3.01 PERFORMANCE**

- A. The Contractor shall implement all reasonable measures, including but not limited to, details outlined herein or shown on the drawings, to ensure minimum damage to the environment during construction and for the long term.
- B. Vegetation adjacent to or outside of access roads, rights-of-way, or cleared construction shall not be damaged.
- C. The Contractor shall be required to protect and preserve existing trees and shrubs in areas designated on the drawings or as otherwise directed by the Owner's Representative. Should any replacement of trees or shrubs be deemed necessary by the Owner's Representative, their number and type shall be shown by the Contractor on a Record Drawing.
- D. All materials to be removed from the site shall be disposed of legally and properly, off-site. Disposal of spoil material shall not be in any flood plain, wetland, or sensitive environmental area.
- E. All abandoned or useless objects including buildings, equipment, supplies, personal property, rubbish, (including those present prior to construction activities) shall be removed from the site in the manner described in the relevant sections of the Specifications.
- F. Temporary structures and storage areas shall not be located in critical environmental areas. Where areas must be cleared for storage of materials or temporary structures, provisions shall be made for regulating drainage and controlling erosion.

**3.02 CLEARING**

- A. Clearing, or any construction activity not specifically authorized shall be prohibited.

- B. Tree trunks and roots, vegetation, and debris shall not be disposed of onsite.

**3.03 EROSION AND SEDIMENTATION CONTROL**

- A. The Contractor shall implement all reasonable measures to minimize erosion.
- B. Cuts, fills and other disturbed areas shall be seeded or sodded as soon as possible to prevent erosion. If such seeding fails to provide adequate cover, the area shall be promptly reseeded.
- C. Water, resulting from dewatering operations, that might reduce the quality of the water in streams, or any other bodies of water, shall not be directly discharged into such bodies.

**END OF SECTION**



**SECTION 02 20 10  
BUILDING PAD EARTHWORK**

**PART 1 - GENERAL**

- 1.01** These specifications are intended to describe work required to construct the building pads.
- 1.02** The building pad area is defined as the area ten (10) feet outside of the proposed building footprint, including attached walkways, canopies, sidewalks, loading docks, garden centers and any other such appurtenances that are necessary for construction.
- 1.03** The Contractor is responsible for bringing all fill within the building pad to the bottom of the proposed under slab materials (nine (9) inches below finished first floor elevation for Phase I Design for Portsmouth Senior Center) and providing a certification to a tolerance of zero (0) to plus one tenth (0.1) feet. The elevation shall be verified by taking readings of subgrade elevation in a 50' grid pattern and taking an average. The maximum variation between readings shall be 0.1'. The Contractor shall submit a plan to the Owner showing pad elevations on this grid pattern certified by a Licensed Land Surveyor registered in the State of New Hampshire prior to the Owner's acceptance of the building pad.
- 1.04** The foundation bearing zone is defined as the area beneath 1H:1V lines extending downward and outward from the lower edges of the footings and below the slab on grade.

**PART 2 - PRODUCTS**

- 2.01 See Section 02 20 20 – Site Earthwork.**

**PART 3.0 – EXECUTION****3.01 BUILDING PAD PREPARATION**

- A. Remove all topsoil/forest mat, subsoil and fill from the building footprints and foundation bearing zones.
- B. Remove all soil material and ledge to twelve (12) inches below bottom of proposed slab and the bottom of the proposed footings. Prior to placing fill soils, the subgrade should be proofrolled with at least six (6) passes of a minimum ten (10) ton vibratory roller. During the proofrolling process, the subgrade should be observed by the geotechnical engineer to identify soft or loose areas. Unstable zones shall be replaced with compacted structural fill as directed by the geotechnical engineer.
  1. Bedrock will not require proof rolling. Mass blasting will be required to excavate the bedrock. Any bedrock loosened below footing elevations shall be removed.
  2. Bedrock subgrades shall be no steeper than 4H:1V and free of loose soil or rock.
    - a. Bedrock subgrades steeper than 4H:1V shall be benched to provide a relatively level bearing surface. Minor irregularities in the level of rock surface shall be filled with lean concrete or crushed stone to provide a level-working surface. The joints in competent bedrock shall be tight, and care should be taken not to displace the joints in the bedrock during excavation. Where not founded directly on sound bedrock there should be at least a twelve (12) inch thickness of structural fill or minus ¾ inch crushed stone placed on the bedrock surface prior to forming the footings. However, if sound bedrock is encountered at underside of footing elevation for the entire area of the footing, isolated spread footings may be founded directly on the sound bedrock. Strip footings may also be founded directly on sound bedrock, provided the section of strip footing on bedrock is at least twenty (20) feet from an adjoining section of strip footing that is founded on native soils or compacted structural fill. Within this twenty (20) foot section, a transition zone should be created to allow differential settlement to be accommodated. Within ten (10) feet of the

change from bedrock support to native soil or compacted structural fill support, the bedrock should be over excavated to allow placement and compaction of a minimum twelve (12) inch thickness of structural fill or minus  $\frac{3}{4}$  inch crushed stone on sound bedrock. From ten (10) feet to twenty (20) feet, the structural fill or minus  $\frac{3}{4}$  inch crushed stone should thin gradually from twelve (12) inches to zero. Compacted structural fill should be placed as required to raise the grade to eight (8) inches below the top of the proposed slab for Phase I Design for Portsmouth Senior Center and nine (9) inches below the top of the proposed slab for Phase I Design for Portsmouth Senior Center.

### **3.02 PLACEMENT OF FILL WITHIN BUILDING PAD AREA**

- A. Fill shall not be placed over frozen soil. Soil that is frozen shall be removed prior to placement of compacted common fill or structural fill. Remove all frozen fill prior to placing additional fill for compaction. Protect fill area by grading to drain and providing a smooth surface, which will readily shed water. Grade the surface of the areas in such a manner as to prevent ponding of surface runoff water in areas to receive compacted fill.
- B. To the extent that it is practicable, each layer of fill shall be compacted to the specified density the same day it is placed. When freezing temperatures are expected do not compact the last lift for the day. Prior to starting work the following day remove frozen material then compact.
- C. Fill that is too wet for proper compaction shall be diced, harrowed or otherwise dried to the proper moisture content for compaction to the required density. If the material cannot be dried within 24-hours of placement, it shall be removed and replaced with drier material.
- D. Fill shall be placed in horizontal layers not to exceed thicknesses specified. Where the horizontal layer meets a natural rising slope, the layer shall be keyed into the slope by cutting a bench.
- E. Fill shall be placed in loose lifts not exceeding twelve (12) inches for self- propelled vibratory rollers and eight (8) inches for vibratory plate compactors. Fill shall be compacted to at least 95 percent of the maximum dry density as determined by ASTM D-1557; Method C.

### **3.03 COMPACTION**

- A. Fills, refills and backfills within new building pad areas shall be compacted as indicated above.
- B. As a minimum, the following testing procedures shall be followed for granular material:
  - 1. Compaction requirements for all soils shall be in accordance with ASTM maximum dry densities as determined by ASTM D-1557; Method C.
  - 2. The in-place soil density shall be determined in accordance with ASTM Standard Method of test for Density of Soil in-place by the Sand Cone Method, Designation D-1556 or ASTM Standard Method of Density of Soil and Soil Aggregate in-place by Nuclear Methods (shallow depth), Designation D-2922.
  - 3. Minimum compaction testing shall be not less than one (1) compaction test for every 2,500 sf in building areas per lift.
  - 4. Minimum documentation to be provided to the Owner's Representative by Testing Agency:
    - a. Report by Testing Agency, including field report and compaction control summary sheet.
    - b. Gradation and moisture density proctor report for all granular materials used on site.
    - c. Report shall consist of narrative and sketch and include as a minimum:
      - Date and job project number on each sheet.
      - Testing lab name, telephone number, and technician name.
      - Location of each test on site sketch.
      - Test sample number shown on site sketch at location of test.
      - Elevation of test (or roller passes if crushed rock).
      - Date(s) of compaction (or number of roller passes if crushed rock).
      - Date(s) of testing (or witnessing roller pass).
      - Lab maximum densities and optimum moisture and field density at each test location

- if applicable.
- Outline of all foundation walls.
- Outline of all underground piping and tracking.
- d. One (1) copy of all final documents to be submitted to the Owner's Representative as they are generated.

**END OF SECTION**

**SECTION 02 20 20  
SITE EARTHWORK****PART 1.0 - GENERAL****1.01 REFERENCES**

- A. Refer to other divisions of these specifications, other sections in this division, and drawings for related work, which may affect the work of this section.
- B. The Contract Drawings indicate limits of construction for this project. These specifications specify material and work requirements for this project. Both are complementary to each other, and both shall be followed to properly complete the work.

**1.02 SCOPE OF WORK**

- A. Provide all labor, materials, equipment, and services, etc. and perform all operations necessary for earthwork required for the execution of all construction as indicated on the drawings, specified herein, or otherwise required for a complete and proper job.
- B. Without limiting the generality thereof, the scope of work under this section shall include, but shall not necessarily be limited to, the following items:
  - 1. Excavation and stockpiling of materials suitable for reuse in an on- site location approved by the Owner.
  - 2. Removing existing material and replacing that material in a suitable manner in accordance with the requirements of the plans.
  - 3. Removal and offsite disposal of existing pavements, foundations, and utilities that may be encountered and backfilling to the grades shown on the plans.
  - 4. Excavation, fill, refill, backfill, subgrade preparation, and compaction as indicated or required, including, but not necessarily limited to, all work related to utilities, walks, pavements, yards, fields, as well as general earthwork.
  - 5. Excavation to subgrade limits and disposal (off-site) of unsuitable or excess materials.
  - 6. Proof rolling subgrade for building pad, pavement areas, walks and utilities.
  - 7. Protection of excavated subgrade areas including diverting surface runoff from excavations. (Note: Subgrade soils, which become wet or unstable after excavation shall be replaced with crushed stone underlain with a woven geotextile fabric. This work is considered subsidiary and will not be paid for as Extra Work).
  - 8. Trench and pit excavations, beddings, fills and backfills, including compaction.
  - 9. Base and sub-base course material under walks and pavements including compaction.
  - 10. Rough and finish grading.
  - 11. Dewatering and control of water for all construction operations.
  - 12. Protection of existing buildings, pavements, walks, utilities, landscaping, etc. to remain.
  - 13. Dust, erosion, siltation, and environmental controls.
  - 14. Sheet piling, shoring and bracing of all excavations and as otherwise required.
  - 15. Removal and disposal of building debris and fire debris at a facility properly permitted to accept this debris and provide documentation of disposal to Owner.
- C. Limits Of Sitework At Building/Site Interface
  - The Contractor is responsible for completing all work detailed on the drawings and Contract Documents, including the following work at the building/site interface.
  - 1. The excavation and grading to subgrade required for the construction of all loading area pads and compactor pads.
  - 2. Coordination with the City/Town Water Department, and construction of water services to within five (5) feet of the outside edge of the foundations and connection of these lines to the building water system.
  - 3. The construction of the roof drain leaders to within five (5) feet of the outside edge of the foundations and connection of these leaders to the storm drainage system. This work also includes installation of drain lines to connect canopy drains at building front.
  - 4. The construction of the entire site lighting system shown on the drawings to within five (5)

- feet of the building foundations and the connection of the wires for the system to the junction box located within the buildings.
5. The construction of the electric conduit to the transformers. Also included is furnishing, equipment and materials, excavation, backfill and grading necessary for the transformer and pad installation.
  6. The construction of the communications conduits to within five (5) feet of the outside edge of the foundations and the connection of these conduits to the building conduits.
  7. Backfill and compaction of building sidewalk excavation and the pad excavations at the curb line after the forms are stripped.
  8. Building pad preparation to an elevation of nine (9) inches below the top of slab for Phase I Design for Portsmouth Senior Center.
  9. The construction of the aggregate base course beneath the building slab.
  10. The construction of concrete sidewalks, steps, pads, slabs and their aggregate bases.
  11. Construction of water services to five (5) feet outside building.
  12. Construction of roof leaders to five (5) feet outside building.
  13. Construction of the sanitary sewer lines to five (5) feet outside building.
  14. Items indicated as by Other (BO) or Not in Contract (NIC) on the drawings.

## **1.02 LAW AND REGULATIONS**

- A. All work shall be accomplished in accordance with regulations of local, county and state agencies and national or utility company standards as they apply.

## **1.03 SITE INVESTIGATION**

- A. The Contractor acknowledges that he has satisfied himself as to the nature and location of the work, the general and local conditions, particularly those bearing upon transportation, disposal, handling, and storage of materials, availability of labor, water, electric power, roads and uncertainties of weather, ground water table or similar physical conditions at the site, the confirmation of subsurface materials to be encountered, the character of equipment and facilities needed prior to and during the prosecution of the work and all other matters which can in any way affect the work or the cost thereof under this contract. Any failure by the Contractor to acquaint himself with all information concerning these conditions will not relieve him from responsibility for estimating properly the difficulty or cost of successfully performing the work.

## **1.04 JOB CONDITIONS**

- A. Dust Control
  1. Use all means necessary to control dust on and near the work and on and near all off-site borrow areas if such dust is caused by the Contractor's operations during performance of the work or if resulting from the condition in which the Contractor leaves the site. Thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on the site.
- B. Protection
  1. Use all means necessary to protect all materials of this section before, during, and after installation and to protect all objects designated to remain. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner's Representative and at no additional cost to the Owner.
- C. Bracing
  1. Properly support all trenches and all other excavations in strict accordance with all pertinent rules and regulations. Brace, sheet, and support trench walls and other excavations in such a manner that they will be safe and that the ground alongside the excavation will not slide or settle, and that all existing improvements of every kind, whether on public or private property, will be fully protected from damage. In the event of damage to such improvements, immediately make all repairs and replacements necessary to the approval of the Owner's Representative and at no additional cost to the Owner.

## **PART 2.0 - PRODUCTS**

**2.01 FILL MATERIAL, GENERAL****A. Approval Required**

1. All fill material shall be subject to the review of the Engineer. Qualified materials shall not change in source or character unless requalified. The Engineer's review of a material shall not in any way diminish the Contractor's responsibility to fulfill all requirements of the specifications.

**B. Notification**

For approval of fill materials, the Contractor shall:

1. Notify the Engineer at least four (4) working days in advance of intention to import material.
2. Provide sample to Engineer for the examination and certification of the material.
3. Sources shall be accessible to the Owner, or his agent, for inspection or additional sampling.

**2.02 FILL MATERIAL****A. Crushed Stone**

The material shall consist of gravel, crushed gravel, crushed stone, air-cooled blast furnace slag, or crushed hydraulic-cement concrete free from clay, loam, or organic matter and shall conform to the following gradation:

<u>Sieve Size</u>	<u>Percentage By Weight Passing</u>
1 Inch	100
¾ Inch	90 - 100
3/8 Inch	20 - 55
No. 4	0 - 10
No. 8	0 - 5

**B. Structural Fill**

1. The material shall consist of hard durable particles or fragments of stone or gravel. Materials that break up when alternately frozen and thawed or wetted and dried shall not be used. Fine particles shall consist of natural or processed sand. The materials shall be free of organic, frozen, or other deleterious materials and shall conform to the following gradation:

<u>Sieve Size</u>	<u>Percentage By Weight Passing</u>
8 Inch	100
3 Inch	70-100
¾ Inch	45-95
No. 4	30-90
No. 10	25-80
No. 40	10-50
No. 200	0-12

Note 1: Three (3) inch maximum particle size within twelve (12) inches of the bottom of the slab.

**C. Sand Blanket**

The material shall consist of clean sand free of organic, frozen or other deleterious materials and conform to the following gradation:

<u>Sieve Size</u>	<u>Percentage By Weight Passing</u>
½ inch	90-100
No. 200	0-15

**D. Common Fill and On-Site Fill**

1. The material shall consist of mineral soil free of organics, frozen soil, debris, or other deleterious material. The maximum particle size shall be eight (8) inches and no more than 25% by weight shall pass the Number 200 Sieve:
- E. Geotextile Fabric
  1. The fabric shall be non-woven Mirafi 140N or approved equal.
- F. Drainage Stone
  1. The material shall consist of clean washed natural stone free of any deleterious materials. The maximum particle size shall be 2 inches and no more than 7% shall pass the number 200 sieve.

## **2.03 USE OF MATERIAL**

- A. Crushed Stone
  1. Material meeting at least the minimum requirements of crushed stone specified herein shall be used as a stabilizing layer for pavement and building areas, for utility trenches, saturated areas at or below the water table and as bedding material for utility pipelines.
- B. Structural Fill
  1. Material meeting the minimum requirements of structural fill specified herein shall be used in construction of the building pads.
- C. Sand Blanket
  1. Material meeting at least the minimum requirements of sand blanket specified herein shall be used as backfill material for utility pipelines as indicated on the drawings.
- D. Common Fill
  1. Common fill may be used to achieve finish subgrades outside the building footing bearing zones. Excavated inorganic fill or glaciofluvial sand may be selectively reused as common fill provided that it is free of deleterious material and can be adequately compacted.
- E. On-Site Fill
  1. If on-site fills are found to be suitable and approved by the Engineer, they may be substituted for Common Fill at approved fill locations. The use of On-Site Fill material shall be strictly subject to the prior approval of the Engineer.
- F. Drainage stone
  1. Drainage stone meeting the requirements as specified herein shall be used in all stormwater infiltration systems.

## **PART 3.0 - EXECUTION**

### **3.01 GENERAL**

- A. Familiarization
  1. Prior to all work of this section, the Contractor shall become thoroughly familiar with the site, the building and site conditions, and all portions of the work covered by this section. The Contractor shall satisfy himself, by actual examination of the site of the work, as to the existing conditions, contours and the elevations and the amount of work required under this section.
- B. Protection
  1. The Contractor shall protect existing utilities, the location of which may be shown approximately on the drawings, or which are located in the field by the Contractor or others. Utilities whose location is not known shall be protected insofar as possible. All costs for repair of utilities broken or damaged by the Contractor or his Subcontractors shall be the responsibility of the Contractor.
- C. Inspection and Tests
  1. Do not allow or cause any of the work performed or installed to be covered up or enclosed by work of this section prior to all required inspections, tests, and approvals. Should any of the work be so enclosed or covered up before it has been approved, uncover all such work at no additional cost to the Owner. After the work has been completely tested, inspected and approved, make all repairs and replacements necessary to restore the work to the condition in which it was found at the time of uncovering, all at no additional cost to the Owner.

**3.02 STRIPPING UNSUITABLE OR EXCESS MATERIALS**

- A. All unsuitable or excess materials shall be stripped to subgrade limits from areas of new construction or regrading. Materials suitable for reuse shall be stored in designated locations that will not interfere with building or utility operations. Topsoil shall be stripped and stored before any underlying excavating is begun. Stripped topsoil to be reused shall be free from clay, stones larger than 1" diameter and debris. Excess materials and all materials not suitable for reuse shall be legally disposed of offsite. All excavations shall be performed in a manner to minimize the disturbance of underlying natural ground to remain and existing structures to remain.
- B. The Contractor shall excavate unsuitable material below subgrade limits to specified grades or to suitable subgrade soils in structure and pavement areas in the manner specified below as directed by the Engineer. The Engineer shall determine unsuitable materials to be any material having an unsatisfactory bearing capacity.
- C. The Contractor shall follow a construction procedure, which permits visual identification of subgrade soils. In the event that groundwater is encountered, the size of the open excavation shall be limited to that which can be handled by the Contractor's chosen method of dewatering and allow visual observation of the bottom and placement of crushed stone and backfill in the dry.
- D. If subgrade soils become unstable after they have been exposed, the Contractor may be required to over excavate and backfill with compacted structural fill or crushed stone underlain by geotextile fabric to stabilize areas which may become disturbed due to surface runoff. This work is considered part of the base bid and will not be paid for as Extra Work.
- E. Over Excavation Correction
- F. Excavation beyond indicated or authorized limits shall be refilled with approved common fill or other approved suitable granular soil material. Refills shall be compacted to 95 percent (Modified Proctor) of the maximum dry density at optimum moisture content. Refills shall be provided as required by the Engineer and at no additional cost to the Owner.

**3.03 GRADES AND ELEVATIONS**

- A. The drawings indicate, in general, the alignment and finished grade elevations of site structures. The Owner's Representative, however, may make such adjustments in grades and alignment as are found necessary in order to avoid interferences and other special conditions encountered. Grading between indicated final grades shall provide smooth, even surfaces, except as otherwise required.

**3.04 EXCAVATION FOR SITE STRUCTURES**

- A. The Contractor shall remove completely below grade and above grade all site obstructions, which interfere with the construction of site structures. Any buried slabs, foundations, utilities or other work found shall be completely removed and backfilled with common fill, as specified.
- B. If suitable bearing for structures is not encountered at the depth indicated on the drawings or as required in these specifications, the Engineer shall be notified immediately. The work shall not proceed further until instructions are given.

**3.05 SITE EXCAVATION, FILL AND BACKFILL**

- A. Pavement Subgrade Preparation
  - 1. The existing pavement and fill shall be removed from the site to the subgrade limits indicated on the drawings. The subgrade shall be proof rolled with minimum 10 ton vibratory equipment providing at least six (6) passes in each direction. During the proof rolling process, the subgrade shall be observed by the Engineer, and unstable areas shall be over-excavated to a more competent material as directed. All excess excavated material shall be legally disposed of off-site.
  - 2. Once the subgrade is approved by the Engineer, subgrade fills, where required, may be placed in lifts not exceeding 12 inch thickness and compacted to at least 92 percent of the maximum dry density as determined by ASTM D-1557; Method C. Pavement subgrade fill may consist of compacted common fill.
- B. Unpaved and Landscaped Area Preparation
  - 1. Surficial topsoil/forest mat and fill may be left in-place in landscape and unpaved areas.



Common fill, where required, may be placed in lifts and compacted to at least 90 percent of the maximum dry density as determined by ASTM D-1557.

### **3.06 SITE DEWATERING**

- A. The Contractor should anticipate the need for dewatering in excavations.
- B. Water levels should be controlled to at least two (2) feet below subgrade elevations.
- C. The Contractor shall be required to maintain a dewatered and stable subgrade during construction. Surface water should be diverted away from the excavations. Subgrade soils that become unstable shall be replaced with crushed stone underlain with a geotextile or structural fill.
- D. The Contractor shall provide, at his own expense, adequate pumping equipment (including standby) and drainage facilities to keep the excavated site areas sufficiently dry from groundwater and/or surface runoff so as not to adversely affect site construction procedures or cause excessive disturbance of underlying natural ground
- E. Satisfy all local, state and federal environmental conservation requirements for discharge of groundwater to surface waters. Any such operation may require permits from the New Hampshire Department of Environmental Services.

### **3.07 SHEETING, SHORING AND BRACING**

- A. Provide shoring, sheeting, and/or bracing of excavations as required to assure complete safety against collapse of earth at side of excavations. Alternatively, lay back excavations to a stable slope.
- B. Excavations shall be adequately sheeted, shored and braced as necessary to permit proper execution of the work and to protect all slopes and earth banks until new building walls are cured and acceptable for backfill. Sheet piling shall be installed if required to prevent cave-ins or settlement and to protect workmen and utilities. Shoring and bracing may be removed as the backfilling progresses, but only when banks are safe against caving, taking all necessary precautions to prevent collapse of excavation sides. Bracing of all foundation walls during backfilling and compaction shall be provided as required.
- C. The Engineer may direct that sheeting, shoring, and bracing be left in-place at any time during the progress of the work and direct that timber used for sheeting and bracing, authorized to be left in-place, but cut off at a specified elevation. In removing sheeting or bracing, all necessary precautions shall be taken to prevent voids and collapse of excavation sides. Voids, if formed, shall immediately be filled with gravel and then compacted.
- D. The installation of sheeting, shoring, and bracing shall comply with the safety precautions as outlined in the Associated General Contractors of America "Manual of Accident Prevention in Construction," and all local and state regulations. Dewatering shall be performed as required or as directed by the Engineer for all excavations below ground water level.
- E. Comply with local and state safety regulations and with the provisions of the Occupational Safety and Health Act (OSHA).

### **3.08 PLACING SITE FILL**

- A. Base courses for site structures, pavements, sidewalks, and slabs shall be made with materials indicated on the drawings, and specified in the Standard Specifications.
- B. Frost.
  - 1. Do not excavate to full indicated depth when freezing temperatures may be expected, unless fill material or structures can be constructed immediately after the excavation has been completed. Protect the excavation from frost if placing of fill or structure is delayed.
  - 2. Fill shall not be placed over frozen soil. Soil that is frozen shall be removed prior to placement of compacted fill. Remove all frozen uncompacted soil prior to placing additional fill for compaction.
- C. Protect fill area by grading to drain and providing a smooth surface which will readily shed water. Grade the surface of the areas in such a manner as to prevent ponding of surface runoff water in areas to receive compacted fill.
- D. To the extent that it is practicable, each layer of fill shall be compacted to the specified density the same day it is placed.

- E. Fill that is too wet for proper compaction shall be diced, harrowed or otherwise dried to the proper moisture content for compaction to the required density. If the fill material cannot be dried within forty-eight (48) hours of placement, it shall be removed and replaced with drier fill.
- F. Fill that is too dry for proper compaction shall receive water uniformly applied over the surface of the loose layer. Sufficient water shall be added to allow compaction to the required density.
- G. Fill shall be placed in horizontal layers not to exceed thicknesses previously specified. Where the horizontal layer meets a natural rising slope, the layer shall be keyed into the slope by cutting a bench.
- H. The subgrade areas to be fine graded for loaming and seeding, mulching and landscaping shall be raked to remove all stones larger than 2" diameter and other unsatisfactory material and shall then be rolled. Any depressions, which may occur during the rolling, shall be filled with additional suitable material and the surface regraded and rerolled until true to the lines and grades required. Care shall be taken not to affect the line or grade of walls and footings during grading and rolling operations.
- I. All fill materials shall be spread uniformly by acceptable methods over the areas required to be covered so that the required thickness after compaction shall be obtained. The material shall be thoroughly consolidated by vibratory tampers, hand tamping or other approved means, to the final compacted grades as required. In no case shall the fill materials be placed in excess of twelve (12) inches for each lift before compaction.

### 3.09 SOILS OBSERVATION

- A. The Engineer will perform on-site observations during this phase of the construction operations. The services of the Engineer will include, but not be limited to, the following:
  - 1. Observations during excavation and dewatering within new building and controlled fill areas.
  - 2. Observations during backfilling and compacting operations within that area defined as the building pad and other areas as appropriate.
  - 3. The field observations performed by the Engineer and his presence does not include supervision or direction of the actual work by the Contractor, his employees, or agents. Neither the presence of the Engineer nor any observations performed by him shall excuse the Contractor from meeting the soils and compaction requirements as specified or correcting any defect in his work.
- B. The Contractor shall cooperate fully in obtaining the information desired and shall allow the Engineer sufficient time to make necessary tests and observations.
- C. Payment for testing shall be made by the Owner. If test results indicate inadequate compaction or fill materials not meeting the specifications, all cost associated with correcting deficiencies to the satisfaction of the Geotechnical Engineer and Owner shall be borne by the Contractor.

### 3.10 COMPACTION

- A. Fills, refills and backfills within the new pavement areas, beneath all site structures and slabs, and the various areas listed below shall be compacted to not less than the following specified maximum dry densities as determined by ASTM D-1557. Compaction Requirements

<u>Areas</u>	<u>Minimum Degree of Compaction</u>
1. Within Building Pad Area and the footing bearing zone and below structures	95%
2. Pavement Base and Subbase	95%
3. Below Grassed or Landscaped Areas	90%
4. Trench Bedding and Backfill Material	95%

- B. Methods: The compaction guidelines given below are stated to provide minimum compaction standards only and in no way relieves the Contractor of his obligation to achieve the above specified degree of compaction by whatever additional effort is necessary.

- C. All percentages of compaction specified herein shall be related to the maximum dry density at the optimum moisture content as established by ASTM Test Method D1557, according to ASTM Test Methods D1556, D2922 or D2167. Prior to placing, at least one representative sample of each of the fill materials proposed to be furnished for the earthwork operations to determine gradation and moisture density characteristics.
- D. Test Prior to Placement
  - 1. All soil samples proposed to be used for fills, refills, and backfills shall be delivered to the Owner's Representative by the Contractor in fifty (50) pound sacks. All costs for obtaining, transporting and delivering soil samples to the Owner's Representative shall be borne by the Contractor. Costs for making all laboratory tests required to obtain the characteristics of the materials, including gradation tests, and determination of moisture density relationships, shall be paid for by the Owner.
- E. Tests After Field Compaction
  - 1. Compaction tests shall be performed following field compaction. These tests shall be made by Engineer. These field density tests shall be made to determine the actual in-place densities being attained.
- F. Correction of Improper Compaction
  - 1. If any of the field density test results fail to meet the density as specified herein for the earthwork involved, then the Contractor shall remove all of the earthwork in that portion of the work involved as determined by the Engineer, and shall replace it in accordance with these specifications to the required density. After the work is replaced additional field density tests shall be made by the Engineer, and the Contractor shall reimburse the Owner for all costs for such additional testing.
- G. No rolling equipment shall be used to compact materials within four (4) feet of the vertical faces of any concrete walls or utility pipes. Plate vibratory tampers shall be used in these restricted areas and in other areas too confined to satisfactorily use rolling equipment.

### **3.11 GRADING**

- A. General
  - 1. Perform all rough and finish grading required to attain the elevations shown on the drawings, or as otherwise directed by the Owner's Representative or required for a complete and proper job.
- B. Rough Grading
  - 1. Proper allowances shall be made for paving, or other finish surfaces. Rough grading shall be reasonably even and free from irregularities, and shall provide positive drainage away from structures without ditching or pools.
- C. Fine Grading
  - 1. Any depressions, which may occur, shall then be filled with additional suitable materials and the surface then regraded until true to the lines and grade required. Areas to be fine graded for loaming and seeding shall be raked to remove all stones and other unsatisfactory materials and shall be suitably compacted.
- D. Treatment After Completion of Grading
  - 1. After Grading is completed, permit no further excavating, filling, or grading. Use all means necessary to prevent erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

### **3.12 DUST, EROSION AND ENVIRONMENTAL CONTROLS**

- A. Dust control shall be maintained constantly throughout the construction period and shall be accomplished by sprinkling with water trucks with distributors for that purpose as required or directed by the Owner's Representative to maintain dust control.
- B. The Contractor shall be responsible for exercising every precaution to prevent erosion and siltation of lower elevations and existing drainage systems and watercourses throughout the construction period. All damage caused by inadequate erosion control measures shall be repaired at the Contractor's expense. Erosion control and siltation of lower elevations and existing drainage systems shall be effectively controlled by the construction and continual use of baled hay or straw,

- or filter fabric barriers as shown on drawings and as directed by the Owner's Representative.
- C. All environmental controls shall be performed in accordance with all applicable rules and regulations of local, county and state agencies having jurisdiction.

### **3.13 ROCK REMOVAL**

#### **A. General**

1. This section includes the excavation and disposal of all rock and boulders encountered to the lines and grades indicated on the drawings or as specified. The Contractor shall dispose of the excavated material and shall furnish suitable backfill material in- place of the excavated rock. Rock shall be removed to a minimum depth as detailed on the drawings.
2. The Contractor must obtain blasting permit from the local fire department. Blasting will conform to the requirements of New Hampshire Safety Code Rules and Regulations. The blaster shall be licensed in the State of New Hampshire and shall provide proof of experience with similar types of projects and constraints.

#### **B. Execution - Blasting**

1. Whenever possible, rock excavation shall be by use of modern mechanical means including ripper, large backhoe, jack hammers, predrilling at close spacing to aid excavation and other means selected by the Contractor. The use of explosives shall be limited as much as practicable by utilizing mechanical methods of excavation to the maximum feasible extent throughout the area. If mechanical methods are not feasible, the Contractor shall employ only controlled blasting methods to assist in rock excavation.
2. Controlled blasting is blasting for excavation of rock in which the various elements of the blast (hole size, hole depth, spacing, burden, charge size, distribution, delay sequence) are carefully balanced and controlled to provide a distribution of charge that will excavate the rock to the required contours and depths with as uniform a surface as possible to minimize overbreak, stressing and fracturing of the rock beyond the excavation line. Smooth wall blasting, pre-splitting, cushion blasting and line drilling are examples of operations included in the term "controlled blasting." Blasting mats shall be used on all pre split and production rounds.
3. Blasting shall be supervised and performed by an experienced licensed blaster. Copies of the blasters' license for the State of New Hampshire to purchase, own, possess, transport or use explosives shall be submitted to the Owner's Representative prior to any blasting on the site.
4. The Owner's Representative shall, at all times, have the authority to prohibit or halt the Contractor's methods of blasting and excavation if it cannot be shown that no damage to adjacent structures will occur as a result of the plan.
5. Blasting Criteria
  - a. Perform blasting operations in a manner to minimize noise (over pressure) and vibration. Use blasting procedures and covers providing effective suppression of noises and vibration and employ other abatement measures necessary for protection of both employees and the public. In addition, restrict working hours and schedule operations in a manner that will limit as much as practicable the disturbance to the public in areas adjacent to the work and to occupants of buildings in the vicinity of the work. Compliance with the requirements of this section will not relieve the Contractor from responsibility for compliance with local ordinances, regulations, and other sections.
  - b. Blast holes shall not be drilled through overburden material.
    - All overburden shall be stripped to the top of rock prior to any drilling.
  - c. Blasting shall be done to permit the cut to the lines, grade, and cross sections indicated on the drawings.
  - d. Rock shall be fragmented to less than one cubic yard.
    - Breakage one cubic yard or greater will be further fragmented by mechanical means or block holding at no expense to the Owner.
6. Ground Vibration due to Blasting
  - a. A pre blast survey of nearby adjacent structures and properties shall be performed by the contractor prior to blasting to establish a baseline of existing conditions.
  - b. Conduct blasting operations to avoid damage to structures. Peak particle velocity at

- adjacent structures shall be limited to a maximum 2.0 inches per second.
- c. Blasting adjacent to fresh concrete shall be limited by the Engineer's recommendations.
  - d. Peak particle velocity is defined as the instantaneous maximum vector sum of the velocity vectors in three (3) mutually perpendicular directions at the point of interest.
  - e. When blasting is finished, a final survey of existing conditions shall be made by the contractor to evaluate whether blasting may have caused damage.
7. Test Blasts
- a. Perform a series of small charge test blasts acceptable to the Owner's Representative with monitoring at the site prior to commencement of production blasting. The purpose is to establish local ground-borne vibration and airborne over pressure propagation characteristics and anomalies to aid in determination of efficient charges that will not cause the ground-borne vibration and airborne over pressure limits to be exceeded. Effect of blast sequence and line drilling in amount of overbreak shall also be observed. Schedule and coordinate each test blast with the Owner's Representative. On the basis of these test blasts, submit proposals for full scale blasting in accordance with this section.
8. Blasting Plans
- After completion of blasting trials as specified above and prior to starting operations submit the following details of the proposed blasting operations.
- a. Location, depth, area, anticipated excavation lines and relationship to adjacent excavation and structures
  - b. Diameter, spacing, burden, depth, pattern and inclination of blast holes.
  - c. Type, strength, amount in terms of weight and cartridges of explosives to be used in each hole, on each delay and the total for the blast.
  - d. The distribution of the charge in the holes and the priming of each hole.
  - e. Type, sequence and number of delays; delay pattern.
  - f. Stemming of holes and matting or covering of blast area.
  - g. Qualifications of the person or persons who will be directly responsible for designing each blast, for supervising the loading of the shot and firing it.
  - h. Written notification of direct abutters prior to blasting indicating blasting schedule is required and copies to the Town of Insert Town Name Fire Chief, Police Chief, Town Manager, Town Attorney, Town Planner and Town Engineer is required.
9. Approval
- a. All products, materials, and procedures used for rock excavation by blasting are subject to acceptance by the Owner's Representative. Acceptance by the Owner's Representative of the blasting procedures as listed above shall not relieve the Contractor of his responsibility for the adequacy of his blasting plan to obtain adequate breakage and for limiting vibration, noise, and overbreak.
10. Monitoring
- a. The Contractor shall submit to the Owner's Representative at the time of the blast the following information:
  - b. Date, time and location of blast.
  - c. Amount of explosives used by weight and number of cartridges.
  - d. Total number of delays used and number of holes used for each period.
  - e. On a diagram of the approved blast pattern indicate any holes not drilled, drilled but not loaded, changes in spacing or in pattern of delays or in loading of holes.
  - f. Total number of holes, maximum charges per hole and corresponding delay number.
  - g. An evaluation of the blast indicating tights, areas of significant overbreak, unusual results and any recommended adjustments for the next blast.
    - This information shall be submitted in writing to the Owner's Representative within three (3) calendar days of the blast.
- C. Excess Rock Excavation
- 1. If rock is excavated beyond the limits of payment indicated on the drawings, specified, or authorized in writing by the Owner's Representative, the excess excavation, whether resulting from over breakage or other causes, shall be backfilled, by and at the expense of the

Contractor, with material approved by the Owner's Representative.

**END OF SECTION**

**SECTION 02 21 80  
EARTH TRENCH EXCAVATION AND BACKFILL**

**PART 1.0 - GENERAL**

**1.01 REFERENCES**

- A. Refer to other divisions of these specifications, other sections in this division, and drawings for related work, which may affect the work of this section.
- B. The Contract Drawings indicate limits of construction for this project. These specifications specify material and work requirements for this project. Both are complementary to each other, and both shall be followed to properly complete the work.

**1.02 SCOPE**

- A. This section includes all trench excavation for sewer, water, drainage, electric, gas, telephone and cable pipelines and appurtenances, including drainage sheeting and bracing, backfilling, disposal of surplus material, and miscellaneous grading. All work shall be done as indicated on the drawings and as herein specified.
- B. No backfilling of utilities shall occur until the Contractor receives authorization from the appropriate utility representative.
- C. Excavation for pipelines shall be the width and depth as indicated on the drawings. Excavation for structures and appurtenances shall provide suitable room for their construction.
- D. All pavements shall be cut using a pavement saw.
- E. The Contractor shall furnish and place all sheeting, bracing and supports, and necessary dewatering, and shall carry out the excavation in such a manner as to eliminate all possibilities of undermining or disturbing existing pipelines, utilities, roadways, shoulders and/or structures.

**1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. The following related work is specified and included in other sections of this specification.
  - 1. Section 02 20 20 – Site Earthwork.

**PART 2.0 - PRODUCTS**

**2.01 EQUIPMENT**

- A. Equipment shall be at Contractor's option.

**PART 3.0 – EXECUTION**

**3.01 EXCAVATION**

- A. The Contractor shall perform all excavation of every description and of whatever substances encountered to the depths shown on the drawings or directed by the Owner's Representative.
- B. No extras will be allowed for quicksand excavation, muck excavation or any other type unless specifically provided for in the bidding schedule.
- C. Excavated material may be used at other parts of the construction project as required for fill, etc, if approved by the Owner's Representative. Any surplus material shall be legally disposed of off-site by the Contractor.
- D. The sidewalls of all trench excavation shall be kept as nearly vertical as possible in all roadways, lawns, near building, etc., by sheeting, bracing, or other means. The cost of sheeting, bracing, or other means is subsidiary and no extras will be allowed
- E. The bottom of the trenches shall be accurately graded as required to provide uniform bearing for each section of pipe.
- F. Where damage is liable to result from withdrawing sheeting, sheeting shall be left in-place. Care shall be taken not to excavate below the depth specified.

**3.02 QUICKSAND EXCAVATION**

- A. Where quicksand excavation is encountered, the Contractor shall drive tight sheeting to a depth, which will effectually cut off the flow of sand. Well points and other methods shall follow as rapidly as possible thereafter. A satisfactory foundation must, however, be secured. When pipe is constructed through quicksand excavation, the trench shall be carried to a sufficient depth to permit the pipe to be encased in concrete.

### **3.03 EXCAVATION BELOW TRENCH GRADE**

- A. Where the bottom of the trench shall have been taken out to a greater depth than required, it shall be refilled to the proper grade with bedding material, and be placed and compacted as specified. The Contractor shall receive no additional compensation.

### **3.04 EXPLORATORY EXCAVATION**

- A. When, it is necessary to explore an excavation to determine the best line and grade for the construction or to locate existing utilities for properly carrying out the work, the Contractor shall make such exploratory excavations for such purposes and shall backfill, compact, and maintain the ground surface in a safe and satisfactory condition for travel.

### **3.05 EXCAVATION NEAR EXISTING UTILITIES, ETC.**

- A. It may be necessary to excavate near existing pipes, drains, and other utilities in certain locations. Some of these have been indicated on the drawings, but no attempt has been made to show all of the services and the completeness and accuracy of the information given is not guaranteed.
- B. As the excavation approaches pipes, conduits, or other underground structures and utilities, digging by machinery shall be discontinued and the excavation shall be done by means of hand tools.
- C. When determination of the exact location of a pipe or other underground structure is necessary for doing the work properly, the Contractor may be required to excavate test pits to determine such locations. Such test pits shall be considered as incidental to other excavation, the Contractor shall receive no additional compensation, the work being understood to be included as part of the normal excavation.
- D. If the utility is of the opinion that at any point sufficient or proper support has not been provided, they may order additional supports placed at the expense of the Contractor. Compliance with such order shall not relieve the Contractor from his responsibility for the sufficiency of such supports. It shall be the responsibility of the Contractor to prevent damage to or displacement of utilities, and to consult with and request the concurrence of the utility company's representative in this matter at all locations. The cost of protecting such utilities shall be considered incidental to the cost of installing the pipe.

### **3.06 TRENCH SURCHARGES**

- A. The excavated material shall be placed adjacent to the excavation in a manner to cause no excessive surcharge on the trench bank nor to obstruct free access to structures and appurtenances. Should traffic or other conditions make it impracticable or unsafe to stack material adjacent to trench, it shall be hauled and stored at a location provided by the Contractor, and at the expense of the Contractor. When required, it shall be rehandled and used in backfilling the trench by the Contractor and at his expense.

### **3.07 SHEETING AND BRACING**

- A. The Contractor shall be responsible for the design, construction, maintenance and safety of all sheeting and bracing as required to support the sides of the excavation and to prevent the movement of earth which could in any way damage or endanger adjacent structures, utilities, roadways, increase the width of the excavation to more than that specified, or delay the work.

### **3.08 DRAINAGE AND DEWATERING OF EXCAVATION**

- A. The Contractor shall, during construction, conduct his operations so as to prevent at all times the



accumulation of water, ice and snow in excavations or in the vicinity of excavated areas so as to prevent water from interfering with the progress or quality of the work.

- B. Accumulated water, ice and snow shall be promptly removed and disposed of by dewatering. Disposal shall be carried out in a manner which will not create a hazard to public health; nor cause injury to public or private property, work completed or in progress, or public streets; nor cause any interference in the use of streets and roads by the public.
- C. During construction, when an unstable condition in the pipe subgrade has been created due to the Contractor's excavation, the subgrade shall be stabilized by dewatering or other appropriate means.

### **3.09 BACKFILLING - GENERAL**

- A. In general and unless other material is indicated on the drawings or is specified, material used for backfilling trenches and excavations shall be suitable material which was removed in the course of making the construction excavations or as specified.
- B. Frozen materials shall not be placed in the backfill nor shall material be placed upon frozen material. Previous frozen material shall be removed or shall be otherwise treated as required before new backfill is placed.
- C. Backfilling shall be done as soon as practicable after the pipe has been laid and jointed.

### **3.10 SUITABLE TRENCH BACKFILL MATERIAL**

- A. Suitable backfill material as specified in Section 02 20 20 – Site Earthwork.
- B. Backfill material shall be controlled to prevent segregation of materials, which will result in formation of voids.
- C. The cost of making the excavated material suitable for backfill, or supplying borrow material, will be included in the cost of installing the pipe. There will be no extra payment for borrow, mixing or reconditioning excavated material.
- D. Pipe bedding materials shall be as specified in Section 02 20 20 – Site Earthwork.

### **3.11 BACKFILLING PIPE TRENCHES**

- A. Backfilling shall begin as soon as practicable after the pipes have been installed and approved by the appropriate utility and Owner's Representative. Backfillings shall proceed until complete or is sufficient to allow pipe testing.
- B. Special backfill requirements are specified on the drawings.
- C. Remainder of the trench shall be backfilled as follows:
  - 1. In paved areas, road shoulders and seeded areas, the entire depth of trenches above the special backfill shall be backfilled in six (6") inch layers with suitable backfill material and each layer thoroughly and carefully compacted as specified. Bring backfill up to bottom of gravel base and/or loam.
  - 2. All backfill shall be thoroughly compacted as specified herein.
- D. The nature of the excavated materials will govern both their acceptability for backfill and the method best suited for their placement and compaction in the backfill.
  - 1. Both the materials and the methods shall be subject to acceptance by the Owner's Representative.
  - 2. No stones or rock larger than six (6") inches in the greatest dimension shall be placed in the backfill.
  - 3. No backfill shall be dumped directly into the trench from trucks.

### **3.12 TOP OF BACKFILL**

- A. In paved and shoulder areas, backfill shall be carried up to pavement or shoulder subgrade ready to receive the gravel base. In other areas, backfill shall be brought up to adjacent finished grade minus the depth of any required loam, and so as to provide a finished surface slightly mounded over the trench. Any trenches improperly backfilled, or where settlement occurs, shall be reopened to the depth required for proper compaction, and shall then be refilled and compacted with the surface restored to required grade and degree of compaction, mounded over, and

smoothed off, at no additional expense.

### **3.13 BACKFILL AROUND PIPE STRUCTURES**

- A. The Contractor shall not place backfill against or on structures until they have attained sufficient strengths to support the loads to which they will be subjected, without distortion, cracking, or other damage. As soon as possible after the structures are adequate, they shall be backfilled with suitable backfill material.  
The material shall be placed in uniform layers not to exceed 6 inches and compacted on all sides of the structure.
- B. The material shall be placed and compacted as specified.

### **3.14 COMPACTION**

- A. Compaction densities shall be as specified in Section 02 20 20 – Site Earthwork.
- B. Methods and equipment proposed for compaction shall be subject to the prior acceptance by the Owner's Representative. Compaction generally shall be done with vibrating equipment. Displacement of, or injury to the pipe and structure shall be avoided. Movement of in-place pipe or structures shall be at the Contractor's risk. Any pipe or structure damaged thereby shall be replaced or repaired as directed by the Owner's Representative and at the expense of the Contractor.
- C. Testing:
  - 1. Field density tests may be ordered by the Owner's Representative for each foot of depth of backfill at 50-foot intervals along the trench.
  - 2. The Contractor shall plan his operations to allow adequate time for laboratory tests and to permit taking of field density tests during compaction.
  - 3. Any costs of retesting required as a result of failure to meet compaction requirements shall be borne by the Contractor.

### **3.15 FILL AND GRADING**

- A. Excavated material not required for backfilling around pipes or structures may be used for fill in areas, which require material for regrading upon approval of the Owner's Representative.
- B. The regrading shall be carried out as directed by the Owner's Representative so that all surface water will drain towards swales, drainage structures or drainage pipes.
- C. All material shall be of such nature that after it has been placed and properly compacted, it will make a dense and stable fill.

### **3.16 PROTECTION OF EXISTING STRUCTURES**

- A. All existing conduits, pipes, wires, poles, fences, property line markers and other items which the Owner's Representative decides must be preserved in-place without being temporarily or permanently relocated, shall be carefully supported and protected from injury by the Contractor, at no additional cost. Should such items be injured, they shall be restored by the Contractor, without compensation therefore, to at least as good condition as that in which they were found immediately before the work was begun.

### **3.17 ACCOMMODATION OF TRAFFIC**

- A. Streets and drives shall not be unnecessarily obstructed. The Contractor shall take such measures at his own expense as may be necessary to keep the street or road open and safe for two-way traffic.
- B. The Contractor shall construct and maintain, without extra compensation, such adequate and proper bridges over excavations as may be necessary or as directed for the safe accommodation of pedestrians and vehicles. The Contractor shall furnish and erect, without cost to the Owner, substantial barricades at crossing of trenches, or along the trench to protect the traveling public.
- C. Where deemed necessary, such additional passageways as may be directed shall be maintained free of such obstructions. All material piles, open excavations, equipment, and pipe which may serve as obstructions to traffic shall be protected by proper lights, lanterns, or guards as is

necessary.

- D. All traffic controls shall be in accordance with the Manual on Uniform Traffic Control Devices for Streets and Highways, latest edition.

**3.18 EROSION AND SEDIMENTATION CONTROL**

- A. Contractor shall take all necessary steps to prevent soil erosion.
- B. Contractor shall plan the sequence of construction so that only the smallest practical area of land is exposed at any one time during construction.
- C. Temporary vegetation and/or mulching shall be used to protect critical areas exposed during development.
- D. All temporary erosion and sedimentation control work shall be included in the cost of installing the pipe.

**END OF SECTION**

**SECTION 02 27 00  
EROSION CONTROL****PART 1.0 - GENERAL****1.01 REFERENCES**

- A. All work shall be in compliance with the most current edition of the New Hampshire Dept. of Environmental Services Stormwater Manual.
- B. All work shall be in compliance with the most current edition of the NHDOT Guidelines for Temporary Erosion and Sediment Control and Stormwater Management.

**1.02 SCOPE OF WORK**

- A. Provide all labor, equipment, materials and maintain temporary erosion control devices as specified herein and shown on Plans.
- B. Provide such erosion control measures as may be necessary to correct conditions that develop prior to the completion of permanent erosion control devices or as required to control erosion that occurs during normal construction operations.
- C. Construction operations shall comply with all federal, state and local regulations pertaining to erosion control.
- D. Prior to commencement of construction activities, meet with the Owner's Representative and approval agency to discuss erosion control requirements and develop a mutual understanding relative to details of erosion control.

**1.03 RELATED WORK IN OTHER SECTIONS**

- A. The following related work is specified and included in other sections of this specification.
  - 1. Section 02 10 00 – Clearing, Grubbing and Stripping.
  - 2. Section 02 20 20 – Site Earthwork.

**PART 2.0 - PRODUCTS****2.01 MATERIALS**

- A. Silt Sock: Linear composite system comprised of wood chips or mulch wrapped in geotextile fabric.
  - 1. Silt Sock shall be installed be manufacturer recommendations.
- B. Sand Bags: Heavy cloth bags of approximately one cubic foot capacity filled with sand or gravel.
- C. Mulches: Compost, manure, corn stalks, gravel, crushed stone, loose hay, straw, peat moss, pine straw or needles, sawdust, wood chips, wood excelsior, or wood fiber cellulose.
- D. Mats and Nettings:
  - 1. Jute matting shall be of open weave, single jute yarn averaging 130 pounds per spindle of 14,400 yards. The yarn shall be of loosely twisted construction, not varying the thickness by more than 1/2 its normal diameter. The woven material shall be 48 inches wide, plus or minus one 1 inch, and with approximately 78 warp ends per width of cloth and 41 weft ends per linear yard. The woven material shall weigh 1.22 pounds per linear yard with a tolerance of plus or minus 5 percent.
  - 2. Excelsior matting shall be wood excelsior, at least 35 inches in width, weighing 0.8 pounds per square yard plus or minus 5 percent. The excelsior material shall be covered with a netting on one side to facilitate handling and to increase strength.
  - 3. Staples shall be number 11 (or heavier) plain iron wire, made from lengths of at least 12 inches each.
- E. Seed:
  - 1. Standard conservation mix of 100% annual rye grass.
  - 2. Equivalent seed mixture may be used as approved by the Owner's Representative based on its suitability for use in controlling erosion of the various soil types and slopes.
  - 3. If the seeding fails to grow, it shall be re-established as required to provide

adequate erosion control.

- F. Sod:
  - 1. Grown from certified seed of adapted varieties to produce high quality sod free of any serious thatch, weeds, insects, diseases and other pest problems.
- G. Silt Fence:
  - 1. Shall be as shown on the drawings.

## **PART 3.0 – EXECUTION**

### **3.01 MULCH**

- A. Mulching shall be done immediately after each area has been properly prepared. When seed for erosion control is sown prior to placing the mulch, the mulch shall be placed on the seeded areas within 24 hours after seeding. Hay that has been thoroughly fluffed shall be applied at approximately, three (3) tons per acre unless ordered. Blowing chopped mulch will be permitted when authorized. Authorization will be given when it can be determined that the mulch fibers will be of such length and applied in such a manner that there will be a minimum amount of matting that would retard the growth of plants. Hay mulch should cover the ground enough to shade it, but the mulch should not be so thick that a person standing cannot see ground through the mulch. Matted mulch or bunches shall be removed or otherwise taken care of.
- B. In order to prevent its being blown away, after the mulch has been spread to the required depth, a light covering of loose branches, a system of pegs and strings, or other approved anchoring method shall be employed. Unless otherwise ordered, such means of control shall be removed prior to the acceptance of the project.
- C. All baling wire or rope, such as that used in the shipment of mulch shall be disposed of outside the limits of the project in approved areas.

### **3.02 MATTING**

- A. Surfaces of ditches and slopes to receive matting shall conform to the grades and cross sections shown on the plans and shall be finished to a smooth and even condition with all debris, roots, stones, and lumps raked out and removed. The soil surface shall be sufficiently loose to permit bedding of the matting. Unless otherwise directed, seed ordered shall be applied prior to placement of the matting.
- B. Jute
  - 1. Strips of jute matting shall be placed lengthwise in the direction of the flow of water. Where strips are laid parallel or meet as in a tee, they shall overlap at least four (4) inches. Ends shall overlap at least six (6) inches, shingle fashion. In addition, the upslope end of each strip of the matting shall be turned down and buried to a depth of not less than six (6) inches with the soil firmly tamped against it. The Owner's Representative may require that any other edge exposed to more than normal flow of water be buried in a similar manner.
- C. Check slots, built at right angles to the direction of the flow of water, shall be placed so that one check slot or one end occurs within each 50 feet of length of slope. Check slots shall be constructed by placing a tight fold of the matting at least six (6) inches vertically into the ground. These shall be tamped the same as the upslope ends.

### **3.03 EXCELSIOR**

- A. When excelsior matting is being laid, the material shall be unrolled in the direction of the flow of water.
- B. Where strips of excelsior matting are laid end to end, the adjoining ends shall be butted.
- C. When adjoining rolls of excelsior matting are laid parallel to one another, the matting shall be butted snugly.
- D. Except where jute matting is turned down, all matting shall be spread evenly and smoothly so that it is in close contact with the ground. Bulging seams in either matting material shall be cut out and joints formed as described above. When ordered, additional seed shall be spread over jute matting, particularly at those locations disturbed by building the slots. Jute matting shall then be pressed onto the ground with a light lawn roller or by other satisfactory means.
- E. Matting shall be held tightly to the soil by staples driven approximately vertically onto the ground

flush with the surface of the matting. On slopes flatter than 4:1, staples shall be spaced not more than three (3) feet apart in three rows for each strip, with one row along each edge and one row, alternately spaced, down the center. On grades 4:1 or steeper, staples shall be placed in the same three rows, but spaced 2 feet apart. On all overlapping or butting edges, the number of staples shall be doubled, with the spacing halved; all ends of the matting and all required check slots shall likewise have staples spaced every 12" and matting placed adjacent to boulders or other obstructions shall be stapled with no spaces between the staples, to eliminate any loose edges of matting.

- F. The above specified spacing of staples may be changed as ordered, depending upon varying factors such as the season the year or the amount of water encountered or anticipated.
- G. In driving the staples, care shall be taken so as not to form depressions or bulges in the surface of the matting.
- H. Other Matting. Approved, alternate matting shall be applied in accordance with the recommendations of the manufacturer and as directed.

#### **3.04 SEED FOR EROSION CONTROL**

- A. Seeding, when required, shall be performed as ordered and in accordance with references and standards listed in Section 1.1 References (above).
- B. Areas to be left temporarily and which will be regraded or otherwise disturbed later during construction may be ordered to be seeded to obtain temporary control. The seed shall be sown at the rate indicated on the drawings.

#### **3.05 MAINTENANCE**

- A. If any staples become loosened or raised, or if any matting becomes loose, torn, or undermined, satisfactory repairs shall be made immediately.
- B. Hay mulch that blows or washes away shall be replaced immediately.

#### **3.06 SILT SOCK FOR EROSION CONTROL**

- A. Silt Sock shall be placed as ordered or shown on the plans to provide for temporary control of erosion or pollution or both. They shall be installed per manufacturer requirements. Upon acceptance of the contract, the silt socks shall be removed unless otherwise ordered by the Owner's Representative.

**END OF SECTION**

**SECTION 02 41 00  
SELECTIVE DEMOLITION & ALTERATIONS**

**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Selective demolition of built site elements.
- B. Selective demolition of building elements for alterations purposes and as otherwise required for the complete and proper execution of the Work.
- C. The Work of this Section is not necessarily fully represented on the Drawings or specifically identified herein. The Contractor, either himself or through his various subcontractors, shall thoroughly review all available documents and shall visit the site and existing building prior to bidding, as required to fully satisfy himself as to the types, locations and quantities of demolition work required for the complete and proper execution of the Work. No pleas of misunderstanding resulting from the failure to adequately inspect existing conditions will be entertained and no additional expenses related thereto will be granted.

**1.02 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.

**1.03 DEFINITIONS**

- A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.
- B. Remove and Retain: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner's designated storage area.
- C. Remove and Reinstall: Remove items indicated; clean, services, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.
- D. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Site Plan: Showing:
  - 1. Areas for temporary construction and field offices.
- C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
  - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
  - 2. Identify demolition firm and submit qualifications.
  - 3. Include a summary of safety procedures.
- D. 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.

**1.06 PROJECT CONDITIONS**

- A. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work. Hazardous materials will be removed by the Owner under separate contract.
  - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.
  - 2. If lead paint is encountered, notify the Architect and Owner. As a minimum, comply with OSHA 1926.62 federal guidelines regarding safety of employees in exposure to lead in construction.

**PART 2 PRODUCTS****2.01 MATERIALS**

- A. For replacement of Work removed, use materials that comply with the pertinent Sections of these Specifications. All other materials, not specifically described but required for a complete and proper job, shall be as selected by the Contractor, subject to the approval of the Architect.

**PART 3 EXECUTION****3.01 SPECIAL REQUIREMENTS FOR DEMOLITION**

All methods, techniques and procedures of safety, shoring, barricading, fencing, protection, demolition, removal and disposal are left solely to the discretion of, and shall be the responsibility of the Contractor. Special attention shall be paid to the issues of safety and protection of existing construction and/or landscaping and site improvements to remain. The Contractor shall take all precautions necessary to prevent the movement, settlement, or failure of adjacent construction. See Section 01 00 00 - General Requirements, for additional information.

- A. The Contractor shall be responsible for compliance with all applicable Local, State and Federal environmental regulations, including but not limited to the National Emission Standard for Hazardous Air Pollutants, as enforced by the United States Environmental Protection Agency. It shall be the Contractor's responsibility to provide all inspections and notifications related thereto.

**3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS**

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain and pay for all required permits and approvals required for demolition, hauling, dumping and in general, all activities related to the Work of this Section.
  - 2. Comply with applicable requirements of NFPA 241.
- B. The Contractor shall be alert to potential problems or dangerous conditions. He/she shall exercise caution during demolition or removal which may affect structural safety. He/she shall proceed only when he has fully satisfied himself that he has provided proper support, shoring, bracing, protection, and safety precautions.
  - 1. If uncovered conditions are not as anticipated, immediately notify the Architect and secure needed directions. Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved
  - 2. Provide, erect, and maintain temporary barriers and security devices.
  - 3. Use physical barriers to prevent access to areas that could be hazardous to workers.
- C. Do not begin removal until receipt of notification to proceed from Owner.



1. Prior to notification to proceed the Contractor shall schedule a pre-demolition site walk through with the Owner. The intent of the walk through is to identify potential built elements required to be salvaged.
- D. Do not begin removal until built elements to be salvaged or relocated have been removed.
- E. Protect existing structures and other elements that are not to be removed.
  1. Provide bracing and shoring.
  2. Prevent movement or settlement of adjacent structures.
  3. Stop work immediately if adjacent structures appear to be in danger.
- F. 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.
- G. The Architect's Scope of Services and responsibilities exclude the investigation, discovery, detection, identification, presence, leakage, release, use, handling, disposal, encapsulation, abatement, treatment or removal of, or exposure of a person or persons to, hazardous materials, pollutants, contaminants, or disease transmitting organisms, preexisting or otherwise deposited at any time and in any form at the Project, including but not limited to volatile organic compounds, molds, fungus, bacteria, petroleum products, lead, asbestos or asbestos products, radon and electro-magnetic frequency radiation or other radiation. Should any such substances be encountered, the Owner and Architect shall be promptly notified, in writing.
- H. Perform demolition in a manner that maximizes salvage and recycling of materials.
  1. Comply with requirements of Section 01 74 19 - Waste Management.
  2. Dismantle existing construction and separate materials.
  3. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

### **3.03 EXISTING UTILITIES**

- A. The termination, demolition, and removal of utilities shall comply with the procedures, regulations, and recommendations of related utilities and governing authorities. The Contractor shall contact such agencies prior to proceeding, in order to assess their requirements and ensure proper coordination and full compliance.
- B. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- C. Protect existing utilities to remain from damage.
- D. Do not disrupt public utilities without permit from authority having jurisdiction.
- E. 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.
- F. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

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

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
  1. Verify that construction and utility arrangements are as shown.
  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 as required to accomplish new work.
  - 1. Remove items indicated on drawings.
- C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunications, and data systems): 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 ; 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 if necessary.
  - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
  - 3. Repair adjacent construction and finishes damaged during removal work.
  - 4. Patch as specified for patching new work.
  - 5.

### **3.05 DEBRIS AND WASTE REMOVAL**

- A. Remove debris, junk, and trash from site.
- B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 74 19 - Waste Management.
- C. Contractor shall leave the site in neat, clean and safe condition, with all appropriate barricades, fencing, warning signage, etc. securely in place, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

### **END OF SECTION**

**SECTION 02 50 00  
PAVING, CURBS AND WALKS**

**PART 1.0 - GENERAL****1.01 REFERENCES**

- A. Refer to other divisions of these specifications, other sections in this division, and drawings for related work, which may affect the work of this section.
- B. The Contract Drawings indicate limits of construction for this project. These specifications specify material and work requirements for this project. Both are complementary to each other, and both shall be followed to properly complete the work.

**1.02 SCOPE OF WORK**

- A. Without limiting the generality thereof, the work under this section consists of furnishing all labor, equipment, supplies and materials and performing all operations in connection with the placing and compacting of gravel subbase and base, bituminous concrete base and wearing courses, cleaning and sweeping areas within the work under this contract and all other operations and incidental work pertaining thereto; all to be in accordance with these specifications and drawings.
- B. The Contractor shall schedule a pre installation meeting with the Owner prior to the installation of pavement, curbs, and walks.

**1.03 RELATED WORK IN OTHER SECTIONS**

- A. Following is a list of related work items performed or furnished under other sections.
  - 1. Section 02 10 00 – Clearing, Grubbing and Stripping.
  - 2. Section 02 20 20 – Site Earthwork.
  - 3. Section 02 75 00 – Storm Drainage.

**1.04 GRADES AND ELEVATIONS**

- A. The drawings indicate, in general, the alignment and finish grade elevations. The Owner's Representative, however, may make such adjustment in finish grades alignment as is found necessary.

**PART 2.0 - PRODUCTS****2.01 PRODUCTS**

- A. Base Courses
  - 1. Aggregate subbase and base courses shall be in accordance with the applicable paragraphs of Section 304 - Aggregate Base Course of the New Hampshire Department of Transportation Standard Specifications for gravel and crushed gravel.
- B. Bituminous Concrete Pavement
  - 1. Bituminous concrete pavement shall be in accordance with the applicable paragraphs of Section 401 Plant Mix Pavements - General, for Bituminous Concrete of the New Hampshire Department of Transportation Standard Specifications for base and wearing courses, for pavement leveling and overlay courses and pavement replacement. Bituminous concrete pavement shall be supplied from only NHDOT approved asphalt mix plants.
- C. Bituminous Sidewalks
  - 1. Bituminous concrete sidewalks shall be in accordance with the applicable paragraphs of Section 608 – Sidewalks – For Bituminous Sidewalks of the New Hampshire Department of Transportation Standard Specifications.
- D. Curbs
  - 1. Curbs shall be constructed in locations shown on the plans and in accordance with the applicable paragraphs of Section 609 – Curbs of the New Hampshire Department of Transportation Standard Specifications.

**E. Cast-In-Place Concrete Sidewalks**

1. Cast-In-Place concrete sidewalks shall be in accordance with the applicable paragraphs of Section 608 – Sidewalks – For concrete Sidewalks of the New Hampshire Department of Transportation Standard Specifications.

**PART 3.0 - EXECUTION****3.01 PREPARATION****A. Subgrades**

1. Do all necessary regrading and fine grading to bring subgrades to the required grades and section, including compaction of the subgrade surface prior to placing the gravel base courses.
2. Compact the existing subgrade as specified in Section 02 20 20 – Site Earthwork.

**B. Adjustment of Existing Castings to Remain**

1. All cast iron manhole frames and covers, catchbasin frames/grates, valve boxes, monitoring wells and all other castings located within the areas of new pavements and replacement areas shall be adjusted to the new pavement surface prior to commencing paving.

**3.02 CONSTRUCTION****A. Gravel Subbase and Base Courses**

1. Place and compact the gravel subbase and crushed gravel base courses in accordance with the applicable paragraphs of the Standard Specifications.
2. The base courses shall be compacted as specified in Section 02 20 20 - Earthwork.
3. It is the intent of these compaction requirements that the minimum in-place dry density of the compacted materials resulting from passes of the compaction equipment will be equal to or greater than the minimum percentages specified herein. Additional passes of the specified equipment will be required if the minimum percentages of ASTM in-place dry densities as specified are not obtained. Moisture conditioning by wetting or drying shall be used as required or directed to obtain the required compaction results.

**B. Pavement Binder and Wearing Courses**

1. Paving shall consist of a bituminous concrete base course pavement and wearing course as shown on the Drawings and Details. Paving shall be constructed in accordance with the applicable paragraphs of the Standard Specifications.

**END OF SECTION**

**SECTION 02 50 10  
RECLAIMED STABILIZED MATERIAL**

**PART 1.0 - GENERAL**

**1.01 DESCRIPTION**

- A. This work shall consist of scarifying if necessary and pulverizing the existing pavement together with a base course material. It may require removal and re-handling and may require the addition of other materials as shown on the plans or as ordered by the Owner's Representative.

**PART 2.0 – PRODUCTS**

**2.01 GENERAL**

- A. The material shall consist of the existing pavement blended with the underlying granular material or additional processed gravel.
- B. Reclaimed stabilized material shall have a maximum particle size of three (3) inches.
- C. Additional processed gravel shall meet the requirements of processed gravel for subbase of the Standard Specifications.

**PART 3.0 - EXECUTION**

**3.01 CONSTRUCTION**

- A. The existing pavement shall be pulverized together with the underlying base course or additional processed gravel. The pulverizing operation shall blend the existing pavement and base course into a homogeneous mass, utilizing the bitumen contained in the pavement as a stabilizer. The quantity of material mixed with the existing pavement shall be adjusted as necessary.
- B. The reclaimed stabilized material shall be processed, utilizing scarifying equipment and a traveling hammermill or other approved reclaimers. Equipment such as a milling machine or a rock crushing plant will not be permitted.
- C. Water shall be applied, as ordered, for the purpose of dust control and to ensure proper compaction. Water may be added during fine grading to improve workability.
- D. Compaction requirements are indicated in Section 02 20 20 – Site Earthwork.
- E. Excess material, unless specified otherwise, shall become the property of the Contractor.
- F. Reclaimed stabilized material shall be processed in areas designated by the Owner's Representative. The reclaimed stabilized material shall be moved to the new pavement areas and placed on the prepared surface to the depths specified.

**END OF SECTION**

**SECTION 02 51 00  
BITUMINOUS PAVEMENT SAWCUT & PATCH**

**PART 1.0 - GENERAL**

**1.01 REFERENCES**

- A. Refer to other divisions of these specifications, other sections in this division, and drawings for related work, which may affect the work of this section.
- B. The Contract Drawings indicate and show limits of construction for this project.
- C. These specifications specify material and work requirements for this project. Both are complimentary to each other, and both shall be followed to properly complete the work. In case of conflict the drawings shall govern.

**1.02 SCOPE OF WORK**

- A. This work shall include the removal of existing bituminous pavement by sawcutting areas of existing pavement areas and removing all bituminous and base material to the pavement subbase, then replacing with new pavement and base courses as indicated on the drawings.

**1.03 EQUIPMENT**

- A. Equipment used for sawing bituminous concrete pavement shall be a gasoline powered wet blade or air cooled pavement saws . Cutting type roller blades will not be allowed. Existing bituminous concrete shall be carefully removed so as not to disturb the existing pavement to remain.

**1.04 MATERIALS**

- A. Hot bituminous concrete shall be equal to and in accordance with the drawings.
- B. Granular base material shall be as specified on the drawings.

**1.05 CONSTRUCTION**

- A. The existing bituminous concrete shall be removed completely from within area sawcut to its full depth.
- B. Material removed during this operation shall be properly disposed of off- site.
- C. No permanent pavement shall be placed over backfill until compaction has been completed.
- D. The Contractor will be required to hose clean or sweep all road surfaces after backfilling and before any surfacing is done.
- E. Base material shall be approved granular base having a minimum thickness as indicated on the drawings.
- F. The existing edges of all pavement along the line of the excavation shall be saw cut back from exposed edges thereof, a sufficient distance to form a sharp, clean, straight edge. The minimum lateral cutback from top of trench wall will be one (1) foot. The cut back pavement will be carefully removed.
- G. A bituminous concrete surface shall be constructed to match the thickness indicated on the drawings. The edges of abutting bituminous surfacing shall be painted with an emulsion to assure a satisfactory, watertight bond between the two materials.
- H. The bituminous pavement courses shall be rolled thoroughly using rollers weighing approximately ten (10) tons, but not heavy enough to damage existing pavement.

**END OF SECTION**

**SECTION 02 55 00  
PAVEMENT STRIPING**

**PART 1 - GENERAL**

**1.01 REFERENCES**

- A. Refer to other division of these specifications, other sections in this division, and drawings for related work, which may affect the work of this section.
- B. The Contract Drawings indicate and show limits of construction for this project. These specifications specify material and work requirements for this project. Both are complementary to each other, and both shall be followed to properly complete the work.

**1.02 SCOPE OF WORK**

- A. Without limiting the generality thereof, the scope of work under this Section shall include all labor, materials, accessories, service and equipment necessary to furnish and apply all pavement striping, parking stalls, and traffic markings as indicated on the drawings and as specified herein.

**1.03 GUARANTEE**

- A. The Contractor is to furnish the Owner with a one (1) year unconditional guarantee against fading, chipping, peeling, wearing, etc., for said one year period. The Contractor is to provide said guarantee in writing, in a form acceptable to the Owner's Representative.

**PART 2 - PRODUCTS**

**2.01 PRODUCTS**

- A. All paint for parking stall and traffic markings shall be fast drying white and yellow traffic paint as specified on the drawings.
- B. Material used shall be in accordance with the Standard Specifications, but shall not be installed until the top course of pavement has cured at least a week. No reflective glass beads will be required.
- C. The material shall not lift from the pavement in the freezing weather, and shall not smear or spread under normal traffic conditions or at temperature below 120 degrees F.
- D. The paint shall not deteriorate by contact with sand, sodium, chloride, calcium chloride or other chemicals used against the formation of ice on the pavement, because of the oil content of pavement materials, or from gasoline, grease and oil drippings from vehicles.

**PART 3.0 - EXECUTION**

**3.01 APPLICATION**

- A. Pavement striping and marking shall be applied in accordance with this specification and the drawings. See drawings for layout and additional notes. No paint shall be applied until the top pavement course has cured at least one-week minimum.
- B. Stripe all stalls as shown on the drawings, accurately and paint all parking stall striping in white 4" wide stripes, stop lines and lettering shall be painted white, to the size, length, and spacing as specified and indicated on the drawings.
- C. All stripes shall be applied one coat with brush, spray or marking machine over dry clean pavement only.
- D. All paint shall be installed at a rate of not more than 300 linear feet of 4" wide lines per gallon of paint (approximately 0.016").
- E. Furnish only skilled workmen who are experienced and normally employed in the work of installing traffic lines. Supply all the necessary equipment and materials for the installation of the traffic lines.
- F. If material is applied to the pavement by an extrusion method one side of the shaping die shall be

- the pavement and the other three (3) sides are contained by, or are part of, suitable equipment for controlling the flow of paint.
- G. All stalls shown on the plan shall be spaced equally as indicated on the drawings.
  - H. Where entire areas are to be crosshatched as directed by the drawings or the Owner's Representative, 4" wide straight parallel stripes 36" o.c. shall be laid out and painted in solid lines or as indicated on the drawings.
  - I. After application and proper drying time, the material shall show no appreciable deformation or discoloration under traffic conditions and in air and/or road temperature ranging from zero degrees F. to 120 degrees F.
  - J. The stripe shall maintain its original dimensions and placement. The exposed surface shall be free from tack. Cold ductility of the material shall be such as to permit normal movement with the pavement surface without chipping or cracking.
  - K. The Contractor shall clean and sweep all areas to be striped or restriped of all sand, dirt, grease, oil, etc., as required so as to produce a first class job. By proceeding, the striping subcontractor agrees surface is satisfactory to produce the required first class job and one year guarantee described.
  - L. The Contractor shall protect the building, walks, pavement, curbing, trees, shrubs, mulch, cars, etc. from over-spray of paint and damage by his operations.
  - M. Traffic shall not be permitted on the pavement until the paint is thoroughly dry.

**END OF SECTION**



**SECTION 02 64 90  
PLANTING****PART 1.0 - GENERAL****1.01 REFERENCES**

- A. Refer to other divisions of these specifications, other sections in this division, and drawings for related work, which may affect the work of this section.
- B. The Contract Drawings indicate and show limits of construction for this project. These specifications specify material and work requirements for this project. Both are complementary to each other, and both shall be followed to properly complete the work.

**1.02 SCOPE OF WORK**

- A. Work included - Perform the following items of work required to complete the work of this section, as shown on the drawings and specified herein.
  - 1. Loam Borrow
  - 2. Preparation of Backfill Mix
  - 3. Planting
  - 4. Maintenance

**1.03 SAMPLES**

- A. Prior to ordering the below listed materials, submit representative samples to Owner's Representative for selection and approval. Do not order materials until Owner's Representative approval has been obtained. Delivered materials shall closely match the approved samples.
  - 1. Loam Borrow: The Contractor shall provide representative samples for testing and approval as directed by the Owner's Representative. The Contractor shall deliver samples to testing laboratory, having testing report sent directly to the Owner's Representative, and pay all costs.
    - a. Mechanical and chemical (pH soluble salts) analysis shall be by a public extension service agency or a certified private testing laboratory in accordance with the current standards of the "Association of Official Agricultural Chemists."
    - b. Report shall be submitted before any loaming is to be done. Soil tests shall be tested for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium Aluminum, Soluble Salts and show acidity of the soil.
  - 2. Pine Bark Mulch: Submit one sample.
  - 3. Antidesiccant: Submit manufacturer.
  - 4. Tree Paint: Submit manufacturer.
  - 5. A standard soil test shall be performed by a Soil and Plant Tissue Testing Laboratory for each distinct newly landscaped area where soil properties or use may differ, sampling locations shall be reviewed by the Owner. A turf establishment plan (including fertilization program) shall include the soil analyses results and shall incorporate the accompanying recommendations. Said plan shall be submitted to the Owner for approval in writing at least six (6) weeks prior to implementation.

**1.04 CERTIFICATION OF ACCEPTANCE AND GUARANTEE**

- A. After the minimum thirty-day maintenance period, the Contractor shall request the Owner's Representative, in writing, for an inspection to determine whether the plant material is acceptable. If the plant material and workmanship are acceptable, written notice will be given by the Owner's Representative to the Contractor stating that the guarantee period begins from the date of the Certificate of Acceptance.
- B. If a substantial number of plants are sickly or dead at the time of inspection, acceptance will not be granted, and the Contractor's responsibility for maintenance of all the plants shall be extended until replacements are made. All dead and unsatisfactory plants shall be promptly removed from the project. Replacements shall conform in all respects to the specifications for new plants and shall be planted in the same manner.
- C. Plants shall be guaranteed for a period of one year after inspection and acceptance and shall be

- alive and in satisfactory growth at the end of the guarantee period.
- D. At the end of the guarantee period, inspection will be made again. Any plant required under this contract that is dead or unsatisfactory shall be removed from the site. Each plant shall show at least 80% healthy growth and shall have the natural character of a plant of its species in accordance with the American Nurserymen's Association standards. These plants shall be replaced during the normal planting season, until the plants live through one year. A final inspection for acceptance will be made after the replacement plantings have lived through one year.
  - E. All replacements shall be plants of the same kind and size specified in the Plant List. The cost shall be borne by the Contractor, except for possible replacements due to vandalism or neglect on the part of others.
  - F. The Contractor shall provide a physical handbook of maintenance instructions for all plant material installed under his direction. This handbook shall contain all necessary maintenance information, which will enable the Owner to maintain new plantings in a vigorous condition. Before planting work is completed, two (2) handbook copies are to be submitted to the Owner's Representative for approval. Upon the acceptance of the planting work one (1) handbook copy shall be furnished to the Owner for his future reference. The Owner's Representative may require resubmittal of the Owner maintenance instructions if it is determined that the information provided is not sufficient to allow for proper maintenance.

#### **1.05 EXAMINATION OF CONDITIONS**

- A. All areas to be planted shall be inspected by the Contractor before starting work and any defects such as incorrect grading, etc., shall be reported to the Owner's Representative prior to beginning this work. The commencement of work by the Contractor shall indicate his acceptance of the areas to be planted, and he shall assume full responsibility for the work of this section.

### **PART 2.0 - PRODUCTS**

#### **2.01 LOAM**

- A. Loam shall consist of loose friable topsoil with no admixture of refuse or material toxic to plant growth. Loam shall be generally free from stones, lumps, stumps, or similar objects larger than 2 inches in greatest diameter, subsoil, roots, and weeds. The term as used herein shall mean that portion of the soil profile defined technically as the "A" horizon by the Soil Science Society of America. The minimum and maximum pH value shall be from 5.5 to 7.6. Loam shall contain a minimum of 3 percent and a maximum of 10 percent of organic matter as determined by loss by ignition. Not more than 65 percent shall pass a No. 200 sieve as determined by the wash test in accordance with ASTM D 1140. In no instance shall more than 20% of that material passing the No. 4 sieve consist of clay size particles.
- B. The topsoil stripped and stockpiled on the site may be used provided that, after testing and addition of necessary additives, it meets the above specification. The Contractor shall provide additional loam as required to obtain the volume called for on the drawings. All excess loam, if any, shall be removed from the site by the Contractor at the completion of the work at no additional cost to the Owner.

#### **2.02 SOIL ADDITIVES**

- A. Commercial fertilizer, peat, humus or other additives shall be used to counteract soil deficiencies as recommended by the soil analysis and as directed by the Owner's Representative.
  - 1. Commercial fertilizer shall be a product complying with the State and United States Fertilizer Laws. Deliver to the site in the original unopened containers, which shall bear the manufacturer's Certificate of Compliance covering analysis, which shall be furnished to the Owner's Representative. At least 50% by weight of the nitrogen content shall be derived from organic materials. Fertilizer shall contain not less than the percentages of weight of ingredients as follows or as recommended by the soil analysis:

Nitrogen

Phosphorous

Potash

- |                              |     |    |    |
|------------------------------|-----|----|----|
| For deciduous trees & shrub  | 10% | 6% | 4% |
| For evergreen trees & shrubs | 7%  | 7% | 7% |
- B. Humus shall be natural humus, reed peat or sedge peat. It shall be free from excessive amounts of zinc, low in wood content, free from hard lumps and in a shredded or granular form. According to the methods of testing of A.O.A.C., latest edition, the acidity range shall be approximately 5.5 pH to 7.6 pH and the organic matter shall be not less than 85% as determined by weight on an over-dry basis.
- C. Peat moss shall be composed of the partly decomposed stems and leaves of any or several species of sphagnum moss. It shall be free from wood, decomposed colloidal residue and other foreign matter. It shall have an acidity range of 3.5 pH to 5.5 pH as determined in accordance with the methods of testing of A.O.A.C., latest edition.
- D. Manure shall be well-rotted, unleached stable manure not less than eight months and not more than two (2) years old. It shall be free from sawdust, shavings, or refuse of any kind and shall not contain over 25% straw. The Contractor shall furnish information as to kind of disinfectant or chemicals, if any, that may have been used in storage of the manure.
- E. Bone meal shall be fine ground, steam-cooked, packing house bone with a minimum analysis of 23% phosphoric acid and 1.0% nitrogen.
- F. Leaf mold shall be highly organic dark brown to black spongy residue resulting from the well aerated composting of deciduous tree leaves. It shall be at least three (3) years old, without recognizable leaf parts, free of plants and their roots, debris and other extraneous matter and shall be uncontaminated by foreign matter and substances harmful to plant growth. The organic matter shall not be less than 85% by weight as determined by the loss on ignition of oven-dried samples.
- Test samples shall be oven-dried to a constant weight at a temperature of 110° C. The inorganic residue after ignition shall not be finer textured than 4% by weight passing the number 200 sieve with washing.

### 2.03 PLANT MATERIALS

- A. The Contractor shall furnish and plant all plants shown on the drawings, as specified, and in quantities listed on the drawings. No substitutions will be permitted. All plants shall be nursery grown unless specifically authorized to be collected.
- B. Plants shall be in accordance with the U.S.A. Standard for Nursery Stock of the American Association of Nurserymen, latest edition.
- C. All plants shall be typical of their species or variety and shall have a normal habit of growth and be legibly tagged with the proper name. Only plant stock grown within the hardiness of Zones 1 through 5, as established by the Arnold Arboretum, Jamaica Plain, Massachusetts, will be accepted. The Contractor's suppliers must certify in writing that the stock has actually been grown under Zone 5 or harder conditions. Plants not so certified will not be accepted.
- D. The root system of each shall be well provided with fibrous roots. All parts shall be moist and show active green cambium when cut. They shall be sound, healthy and vigorous, well-branched and densely foliated when in leaf. They shall be free of disease, insect pests, eggs or larvae.
- E. All plants must be moved with the root system as solid units with balls of earth firmly wrapped with untreated eight (8) ounce burlap, firmly held in place by a stout cord or wire. The diameter and depth of the balls of earth must be sufficient to encompass the fibrous and root feeding system necessary for the healthy development of the plant. No plant shall be cracked or broken preparatory to or during the process of planting or after the burlap, staves, ropes or platform required in connection with its transplanting have been removed. The plants and balls shall remain intact during all operations. All plants that cannot be planted at once must be heeled in by setting in the ground and covering the balls with soil and then watering them.
- F. The height of the trees (measured from the crown of the roots to the tip of the top branch) shall be not less than the minimum size designated. Take caliper measurement six (6) inches above ground level up to and including four (4) inch caliper size and twelve (12) inches above ground for larger sizes. The trunk of each tree shall be a single trunk growing from a single unmulitlated

crown of roots. No part of the trunk shall be conspicuously crooked as compared with normal trees of the same variety. The trunk shall be free from sunscald, frost cracks, or abrasions resulting from fire or other causes. No pruning wounds shall be present having a diameter exceeding two (2) inches and such wounds must show vigorous bark on all edges. Plants shall not be pruned prior to delivery.

- G. Shrubs shall meet the requirements for spread or height stated in the Plant List. The measurements for height are to be taken from the ground level to the average height of the shrub and not to the longest branch. The thickness of each shrub shall correspond to the trade classification "No. 1." Single stemmed or thin plants will not be accepted. The side branches must be generous, well-twigged, and the plant as a whole well-branched to the ground. The plants must be in a moist vigorous condition, free from dead wood, bruises or other root or branch injuries. Plants shall not be pruned prior to delivery.
- H. Ground cover plants shall be of size, age and/or condition listed in the Plant List. Plants shall be healthy, free of insects and diseases. Ground cover plants shall be potted or in sod.
- I. Container grown stock shall have been grown in a container long enough for the root system to have developed sufficiently to hold its soil together firm and whole. No plants shall be loose in the container.
- J. Plants delivered by truck and plants requiring storage on site shall be properly wrapped and covered to prevent wind-drying and desiccation of branches, leaves or buds; plant balls should be firmly bound, unbroken reasonably moist to indicate watering prior to delivery and during storage and tree trunks should be free from fresh scars and damage in handling. No trees with double-leaders or twin-heads shall be acceptable without the written approval of the Owner's Representative. The Contractor shall reject such plants at time of delivery by the nursery/supplier unless such plants were selected by the Owner's Representative as indicated by tags and seals. No plant material from cold storage will be accepted.

#### **2.04 STAKES, WIRE AND HOSE**

- A. Stakes for supporting trees shall be of sound hardwood of uniform size, reasonably free of knots, with a maximum allowable deflection of one-half inch for every one foot of length, free from insects and fungi and capable of standing in the ground at least two years. Stakes eight to ten feet long shall have a minimum diameter of two to two and one-half inches. Stakes twelve feet long shall have a minimum diameter of three inches. Stakes shall be pointed at one end and shall be stained dark brown.
- B. Hose to encase wires shall be new two ply reinforced rubber garden hose not less than one-half inside diameter. Wire for guying plants shall be new pliable annealed galvanized steel wire, A.S.&W. twelve gauge or gauge as shown on the drawings.
- C. The size and quality of cables, turnbuckles, thimbles, leg hooks, eye bolts, rods, washers and nuts shall be shown on the drawings or as approved by the Owner's Representative.
- D. Drive anchors and guy wire assembly shall be as manufactured by Laconia Malleable Iron Works, Laconia, New Hampshire, or equal. Sizes used shall be in accordance with the manufacturer's specifications and recommendations.

#### **2.05 MULCH**

- A. Mulch shall be aged pine bark mulch aged a minimum of six months. The mulch shall be dark brown in color, free of chunks and pieces of wood thicker than one-quarter inch. Mulch must be free of stringy material and shall not contain, in the judgment of the Owner's Representative, an excess of fine particles. Submit sample for Owner's Representative's approval.

#### **2.06 WRAPPING MATERIAL**

- A. Wrapping material shall be first quality, eight to ten inches wide heavy waterproof crepe paper or six inch wide burlap manufactured for this purpose. Twine for tying shall be a lightly tarred medium or coarse sisal yarn, two ply for trees three inches or less in diameter and three ply for trees over three inches in diameter.

#### **2.07 WATERING**

- A. Water, hose and other watering equipment required for the work shall be furnished by the Contractor. Water shall be free from impurities injurious to vegetation.

## **2.08 ANTIDESICCANTS**

- A. Antidesiccants shall be emulsions or other materials which will provide a protective film over plant surfaces permeable enough to permit transpiration and specifically manufactured for that purpose. Manufacturer of antidesiccant shall be subject to Owner's Representative approval and shall be used only after approval by the Owner's Representative. Antidesiccant shall be delivered in containers of the manufacturers and shall be mixed according to the manufacturer's instructions.

## **PART 3.0 - EXECUTION**

### **3.01 PLANTING**

- A. Furnishing and planting of any plant material includes the digging of the holes, provision of soil additives and loam, furnishing the plants of specified size with roots in the specified manner, the labor of planting and mulching and guying and staking where called for.
- B. Season for planting: April 15 through November 1.
- C. Planting:
  - 1. Location for all plants and outlines for planting areas shall be staked on the ground by the Contractor for approval by the Owner's Representative before any plant pits or plant beds are dug.
  - 2. At least ten (10) days prior to the expected planting date, the Contractor shall request, in writing, that the Owner's Representative provide a representative to select and tag stock to be planted under this section.
  - 3. Plants shall be selected by the Owner's Representative at the place of growth for conformity to specification requirements as to quality, size, and variety. Such approval shall not impair the right of inspection and rejection upon delivery at the site or during the progress of the work. Cost of replacement shall be borne by the Contractor.
  - 4. Maintain at all times during the planting operations one or more stockpiles of approved quality loam.
  - 5. Plant pits shall be excavated with sloped sides. Holes for trees and shrubs shall be three (3) times the diameter of the ball and one foot deeper than the ball.
  - 6. Loam, organic material and fertilizer mix for plant backfill for both planting beds and individual plants shall be thoroughly premixed in the proportions of one part of organic material with seven parts of loam together with fertilizer at the rate determined by soil test. The organic material to be added shall be as directed by the Owner's Representative.
  - 7. Backfill mix for planting beds shall be prepared with the materials as specified above to a minimum depth of 24 inches or as shown on the drawings.
  - 8. Ground cover beds shall be dug to a depth of one foot below final grade, or as shown on the drawings. Incorporate peat moss with back fill loam in the ratio of one part peat moss to two parts loam. Supply sufficient backfill loam and peat where required to provide one foot deep beds.
  - 9. All plant roots and earth balls must be damp and thoroughly protected from sun and wind from the beginning of the digging operation, during transportation and on the ground until the final planting. The plants shall be planted in the center of the holes and at the same depth as they previously grew. Remove burlap, rope, wires, etc. from sides and tops of root balls. Do not pull burlap out from under root balls. Loam shall be backfilled in layers of not more than six inches and each layer watered sufficiently to settle before the next layer is put in-place. Enough backfill mix shall be used to bring the surface to finished grade when settled. A saucer shall be formed around each plant and a depth of six inches for trees or four inches for shrubs.
- D. All plants shall be flooded with water twice within the first twenty-four (24) hours of planting and all plants during the maintenance period shall be watered at least twice each week. At each watering the soil around each tree or shrub shall be thoroughly saturated. If sufficient moisture is retained in the soil, as determined by the Owner's Representative, the required watering may be

- reduced. Trees will require a minimum of ten gallons of water each; shrubs a minimum of five (5) gallons each.
- E. All trees shall be firmly staked, guyed or anchored at the time of planting as shown on the drawings, unless otherwise approved or directed by the Owner's Representative. Stakes shall be plumb and neat in appearance and shall not injure plant balls. Wires used for tying the trunk to stakes or for guying shall be secured to the trees by passing through an approved hose to prevent chafing and injury to the trees.
  - F. Mulch material shall be placed over entire saucer areas of individual trees and shrubs and over the entire area of planting beds to a depth of three (3) inches after settlement, not later than one (1) week after planting. No mulch shall be applied prior to the first watering of plant materials.
  - G. Pruning:
    - 1. Each tree and shrub shall be pruned in accordance with the American Nurserymen's Association Standards to preserve the natural character of the plant.
    - 2. All dead wood or suckers and all broken or badly bruised branches shall be removed. In addition, one-fourth of the wood shall be removed by thinning out and shortening branches to balance root loss due to retransplanting. Never cut a leader.
    - 3. Cuts over one (1) inch in diameter shall be painted with an approved tree paint. Paint shall cover all exposed living tissues.
  - H. Antidesiccant shall be applied to all plants before digging at the nursery and/or as directed by the Owner's Representative once the plants have been delivered to the site.
  - I. If planting is done after lawn preparation or installation proper protection of lawn areas shall be provided and any damage resulting from planting operations shall be repaired immediately at no cost to the Owner.
  - J. In the event that rock or underground construction work or obstructions are encountered in any plant pit or bed excavation work to be done under this contract, alternate locations may be selected by the Owner's Representative.
  - K. Absolutely no debris may be left on the site. Excavated material shall be removed as directed by the Owner's Representative. Repair any damage to site or structures to restore them to their original condition as directed by the Owner's Representative.

### **3.02 MAINTENANCE**

- A. Maintenance shall begin immediately after each plant is planted and shall continue for a minimum of thirty days or until the final acceptance of the project.
- B. Maintenance shall consist of keeping the plants in a healthy growing condition and shall include watering, weeding, cultivating, remulching, tightening and repairing of guys, removal of dead material, resetting plants to proper grades or upright position and maintaining the planting saucer.
  - 1. All plants during the maintenance period shall be watered at least twice each week. At each watering the soil around each tree or shrub shall be thoroughly saturated. If sufficient moisture is retained in the soil, as determined by the Owner's Representative, the required water may be reduced. Trees will require a minimum of ten gallons of water each; shrubs a minimum of five gallons each.
  - 2. Stakes shall be kept plumb and neat in appearance. Guys shall be tightened and repaired weekly.
  - 3. Planting beds and individual plant pits shall be kept free of weeds and mulch shall be replaced as required to maintain a 4" layer of mulch. Beds and individual pits shall be neat in appearance and maintained to the lines originally laid out.
  - 4. Plants that die during the maintenance period shall be replaced as directed by the Owner's Representative.
  - 5. Spraying for both insect pests and diseases shall be included during the maintenance period as required and as directed by the Owner's Representative.

### **END OF SECTION**

**SECTION 02 66 00  
WATER SUPPLY****PART 1.0 - GENERAL****1.01 REFERENCES**

- A. Refer to other divisions of these specifications, other sections in this division and drawings for related work, which may affect the work of this section.
- B. The Contract drawings indicate and show limits of construction for this project. These specifications specify material and work requirements for this project. Both are complementary to each other and both shall be followed to properly complete the work.

**1.02 SCOPE OF WORK**

- A. Work under this section includes the providing of the entire exterior domestic water and fire protection system, connections to the building services and all equipment necessary for the completion of the work as indicated on the drawings and as specified herein. All work must conform to the City of Portsmouth requirements.
- B. Secure and pay for all permits. All inspection, installations and testing fees shall be paid by the Contractor.
- C. No backfilling shall occur without the acceptance of the City of Portsmouth.

**PART 2.0 MATERIALS****2.01 GENERAL**

- A. Materials for new water mains shall be of new and unused materials and shall conform to the requirements of the City of Portsmouth. Materials meeting the requirements specified herein shall be provided if the City of Portsmouth's requirements are less stringent.

**2.02 DUCTILE PIPE AND FITTINGS**

- A. Pipe
  - 1. The ductile iron pipe shall be Class 52 cement lined modified and conforming to AWWA specifications C151 with Megalug type restraints. The bell for this type of joint shall be cast with a shouldered gasket groove of a shape, which will prevent the gasket from being blown or forced out of the joint. Gaskets shall be formed of neoprene and meet the requirements of the AWWA specification C111.
- B. Fittings
  - 1. Fittings shall be ductile iron, 350 psi pressure rating. Ductile iron fittings shall conform to ANSI A21.10/AWWA C110 with mechanical joints. Joints and gaskets shall conform to ANSI A21.11 AWWA C111. Joints shall be furnished with retainer glands. Fittings shall be cement-lined and seal-coated inside and out in accordance with ANSI A21.4/AWWA C104.
  - 2. All hardware shall be stainless steel
- C. Lining and Coatings
  - 1. The inside of ductile iron pipe and fittings shall be given a cement lining and bituminous seal coat in accordance with AWWA specification C104.
  - 2. The outside of ductile iron pipe and fittings shall be coated with bituminous varnish as required in AWWA specification C151.
  - 3. Machined surfaces shall be cleaned and coated with a suitable rust-preventive coating at the shop immediately after being machined.
- D. Rigid Connections
  - 1. The pipe couplings shall be mechanical type, to mechanically engage and lock the grooved pipe ends in a position couple and to allow for some degree of angular deflection and contraction and expansion. Each coupling shall consist of malleable iron housing clamps in two (2) or more parts, a single C-shaped composition sealing gasket with internal sealing lips projecting diagonally inward so that internal pressure serves to increase the tightness of seal when installed and two or more track head stainless steel bolts as required to assemble the

housing clamps. The couplings shall be per town requirements.

### **2.03 COPPER PIPE AND FITTINGS**

- A. Pipe
  - 1. Type K, soft annealed copper seamless water tube, ASTM B88.
- B. Fittings
  - 1. Buried fittings; waterworks brass, compression fittings with Bura N' Gasket acceptable manufacturer: Mueller, Decatur, IL or equal.

### **2.04 VALVES AND APPURTENANCES**

- A. Gate Valves
  - 1. The manufacturer and model shall be per City of Portsmouth requirements. They shall conform to the requirements specified in the governing AWWA Standard for Gate Valves (C509).
  - 2. Gate valves shall per city standards.
  - 3. All gate valves shall be resilient seat wedge, mechanical joint with retainer glands.
  - 4. All hardware shall be stainless steel.
- B. Valve Boxes
  - 1. Unless otherwise specified or required, each buried valve shall be provided with a valve box. Valve boxes shall be ductile iron, sliding Erie type with rod and shall be coated and of the adjustable, slip, heavy pattern type. They shall be so designed and constructed as to prevent the direct transmission of traffic loads to the pipe or valve.
  - 2. The upper or sliding section of the box shall be provided with a flange having sufficient bearing area to prevent undue settlement. The lower section of the box shall be designed to enclose the operating nut and stuffing box of the valve. The boxes shall be adjustable through at least six (6) inches vertically without reduction of the lap between sections to less than four (4) inches.
  - 3. The inside diameter of boxes shall be at least 4-1/2 inches and the lengths shall be as necessary for the depth of the valves with which the boxes are to be used.
  - 4. Covers shall be close fitting and substantially dirt-tight. The top of the cover shall be flush with the top of the box rim. Markings shall be cast in the top of the cover per town requirements.
- C. Wrenches for Buried Valves
  - 1. The Contractor shall furnish one (1) tee handle wrench of sufficient length to permit operation of all buried valves, regardless of depth, by operators of average height working in normal positions.
- D. Painting
  - 1. Interior surfaces of all valves and exterior surfaces of buried or submerged valves and miscellaneous piping appurtenances shall be given a shop finish of an asphalt varnish conforming to Federal specification TT-V-51c, for Varnish, Asphalt, as specified in AWWA specification C500.
  - 2. Parts customarily finished at the shop shall be given coats of paint filler and enamel or other approved treatment customary with the manufacture. After thorough cleaning exterior surfaces of various parts of valves and miscellaneous piping appurtenances exposed within structures shall be given one shop coat of an approved rust inhibitive primer compatible with the field coats and applied in accordance with the instructions of the paint manufacturer.
  - 3. Ferrous surfaces obviously not to be painted shall be given a shop coat of grease or other suitable rust resistant coating.
- E. Hydrant
  - 1. The hydrants shall be per AWWA C502 and shall be from one (1) manufacturer. Hydrants shall be model M&H 929 supplied by Water Works Supply.
  - 2. Hydrant nozzles shall be per City of Portsmouth requirements.
  - 3. Hydrant shall open per City of Portsmouth requirements.
  - 4. Hydrants shall be primed in accordance with the latest AWWA C502 hydrant painting specifications. Paint colors shall be the standard hydrant color of the City of



Portsmouth.

F. Curb Stops

1. Sidewalk curb stops shall be non drainage type.

## **PART 3.0 INSTALLATION**

### **3.01 INSTALLATION**

A. Ductile Iron Pipe and Fittings

1. Laying Pipe and Fittings: Gasket type joints shall be made up by first inserting the gasket in to the groove of the bell and applying a thin film of special non toxic gasket lubricant uniformly over the inner surface of the gasket which will be in contact with the spigot end of the pipe. The end of the plain pipe shall be chamfered to facilitate assembly. The end shall be inserted into the gasket and then forced past it until it seats against the bottom of the socket. All fittings shall be mechanical joint with retainer glands. All push on pipe joints shall have two (2) serrated brass wedges installed to provide electrical continuity.
2. Piping Supports
  - a. The Contractor shall furnish and install all supports necessary to hold the piping and appurtenances in a firm, substantial manner at the lines and grades indicated on the drawings or specified.
3. All bends, tees and other fittings shall be backed up with 3000 psi concrete thrust blocks placed against undisturbed earth where firm support can be obtained. Thrust blocks shall be as shown on the drawing. If the soil does not provide firm support, then suitable bridle rods, clamps and accessories to brace the fitting properly shall be provided. Such bridle rods, etc., shall be coated thoroughly and heavily with an approved bituminous paint after assembly or, if necessary, before assembly.
4. Handling and Cutting Pipe: The Contractor's attention is directed to the fact that ductile iron pipe and the cement lining are brittle.
  - a. Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe or lining, scratching or marring machined surfaces and abrasion of the pipe coating or lining.
5. Any fitting showing a crack and any fitting or pipe which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.
6. In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portion, if so approved, may be cut off by and at the expense of the Contractor before the pipe is laid so that the pipe used may be perfectly sound. The cut shall be made in the sound barrel at a point at least twelve (12) inches from the visible limits of the crack.

B. Copper Water Service Connection

1. Water Service Connections:
  - a. The Contractor shall furnish all labor, material and equipment necessary to install water service connections as herein specified. The work shall include all excavation and backfill.
  - b. Permanent service connections shall be made after the new water main is completed.
  - c. Before any temporary or permanent connection is put into service, the Contractor shall disinfect the piping as specified herein.
2. Jointing:
  - a. Flared Joints
    1. Ream or file the pipe to remove burrs
    2. Slip fitting over end of pipe to be flared
    3. Expand tube using flaring tools
    4. Inspect for cracks, splits or other damages

5. Squarely seat flared end on fitting and tighten
- C. Packed or Compression Joints
  1. Cut pipe squarely
  2. Ream or file pipe to remove burrs
  3. Seat pipe in fittings and tighten

## **PART 4.0 WATER MAIN TESTING AND DISINFECTION**

### **4.01 WATER MAIN TESTING**

- A. Field Testing – Pressure and leakage tests shall be performed as directed by the City of Portsmouth. At a minimum, the following testing procedure shall be followed should the City of Portsmouth's requirements be less stringent:
  1. The pipe shall be given pressure and leakage tests in sections of approved lengths. The Contractor shall furnish and install a suitable temporary testing plug or cap for the pipeline; all necessary pressure pumps, pipe connections and other similar equipment; and all labor required; all without additional compensation. The meter and gauge shall be installed by the Contractor in such a manner that all water entering the section under test will be measured and the pressure in the section indicated and they shall be kept in use during both tests.
  2. The schedule of pressure and leakage tests shall be as directed by the City of Portsmouth in accordance with AWWA specification C600. Minimum testing pressure shall be 150 PSI at the highest point along the test section.
  3. Unless it has already been done, the section of pipe to be tested shall be filled with water of approved quality and all air shall be expelled from the pipe. If hydrants or blowoffs are not available at high points for releasing air, the Contractor shall make the necessary excavations and do the necessary backfilling and the Contractor shall make the necessary taps at such points and shall plug said holes after completion of the test with brass or bronze plugs.
  4. For the pressure test, the Contractor shall, by pumping, raise the water pressure (based on the elevation at the lowest point of the section under test and corrected to the gauge location) to a pressure in pounds per square inch numerically equal to the class rating of the pipe. If the Contractor cannot achieve the specified pressure and maintain it for a period of one hour, the section under test shall be considered as having failed to pass the pressure test.
  5. Following a successful pressure test, the Contractor shall make a leakage test by metering the flow of water into the pipe while maintaining in the section being tested, a pressure equal to the average pressure to which the pipe will be subjected under normal conditions of service. This shall be done by placing the section under system pressure by pumping.
  6. The amount of leaking, which will be permitted, shall be in accordance with the specifications for Installation of Ductile Iron Water Mains by AWWA C600 or as allowed by the town.
  7. If the section shall fail to pass the pressure test, the leakage test, or both, the Contractor shall do everything necessary to locate, uncover, even to the extent of uncovering the entire section and repair or replace the defective pipe, fitting, or joint, all at his own expense and without extension of time for completion of the work.

### **4.02 DISINFECTION AND FLUSHING**

- A. Field Chlorination – Chlorination treatment shall be performed according to AWWA C651-99 or latest version.

**END OF SECTION**

**SECTION 02 70 00  
SANITARY SEWERAGE**

**PART 1.0 - GENERAL**

**1.01 REFERENCES**

- A. Refer to drawings for related work, which may affect the work of this section.
- B. The drawings indicate and show limits for construction of this project. These specifications specify material and work requirements for this project. Both are complementary to each other and both shall be followed to properly complete the work.

**1.02 SCOPE OF WORK**

- A. Furnish and install the sanitary sewerage system, new connections, piping, manholes and all equipment necessary for the completion of the work indicated on the drawings and specified herein. Coordinate all work with the City of Portsmouth.

**1.03 LAWS AND REGULATIONS**

- A. All work shall be completed in accordance with the City of Portsmouth regulations and New Hampshire Department of Environmental Services requirements.
- B. Secure and pay for all necessary permits and connection fees for the municipal and state departments having jurisdiction prior to construction and furnish proof of acceptance upon completion of the work.

**1.04 GRADES AND ELEVATIONS**

- A. The drawings indicate the alignment and utility invert grades. The Owner's Representative, however, may make such adjustment in grades and alignment as is found necessary in order to avoid interference and to adapt the piping to any other special conditions that may be encountered.

**1.05 SUBMITTALS**

- A. Submit Shop Drawings for all sanitary sewerage items described or indicated on the drawings for approval at least four (4) weeks prior to ordering.

**PART 2.0 – MATERIALS**

**2.01 GENERAL:**

- A. Materials for new sanitary sewers shall be of new and unused material and shall conform to the requirements specified herein.

**2.02 PLASTIC PIPE**

- A. Plastic gravity sewer pipe and fittings (PVC) shall conform to ASTM D- 3034, SDR 35 only, polymer compounding and classification shall be in accordance with ASTM D-1784 (Class 1254B).
  - 1. Pipe stiffness, measured in accordance with ASTM D-2412, shall be a minimum of 45 psi and 5% deflection.
  - 2. Joints shall be push-on, bell and spigot-type.
  - 3. Joint seals, for PVC pipe, shall be oil resistant compression rings of elastomeric material conforming to ASTM D-3212.
  - 4. PVC fittings shall be SDR-35 rated.

**PART 3.0 - INSTALLATION OF PIPE**

**3.01 PIPE HANDLING**

- A. The Contractor shall arrange for the delivery of the pipe sections at approved locations in the vicinity of that portion of the sewer line in which the pipe sections are to be laid. To this end, he

shall do such work as is necessary for access and for delivery of the pipe. Pipes shall be stored in an approved, orderly manner so that there will be a minimum of rehandling from the storage area to the final position in the trench and so that there is a minimum of obstruction and inconvenience to any kind of traffic. Deliveries shall be scheduled so that the progress of the work is at no time delayed and also so that large quantities of pipe shall not be stored for excessive lengths of time in crowded locations or in locations where large storage areas might be considered objectionable. Storage of pipe will be restricted to approved or permitted areas.

- B. Each pipe section shall be handled into its position in the trench in such manner and by such means as the City of Portsmouth approves as satisfactory and these operations will be restricted to those considered safe for the workmen and such as to cause no injury to the pipe or to any property.
- C. The Contractor shall be required to furnish slings, straps and/or approved devices to provide satisfactory support of the pipe when it is lifted. Transportation from delivery areas to the trench shall be restricted to operations, which can cause no injury to the pipe units.
- D. The pipe shall not be dropped from trucks or into the trench.
- E. The Contractor shall have on the job-site with each pipe laying crew, all the proper tools to handle and cut the pipe. The use of hammer and chisel, or any other method, which results in rough edges, chips and damaged pipe, shall be prohibited.
- F. Damaged pipe coating and/or lining shall be restored before installation.

### **3.02 CONTROL OF ALIGNMENT AND GRADE**

- A. The Contractor will establish the location of the pipe, manholes and other appurtenances and will establish benchmarks along the route of the pipelines at convenient intervals for his own reference in checking the pipe and manhole invert and other elevations throughout the project.
- B. The Contractor shall use a laser beam to assist in setting the pipe.
- C. The use of string levels, hand levels, carpenters levels or other relatively crude devices for transferring grade or setting pipe will not be permitted.
- D. The Contractor shall not proceed until he has made timely demand upon the City of Portsmouth for and has received from them, such controls and instructions as may be necessary as the work progresses. The work shall be done in strict conformity with such controls and instructions. The Contractor shall carefully preserve benchmarks, reference points and stakes and in case of willful or careless destruction by his own men, he will be charged with the resulting expense and shall be responsible for any mistakes or delay that may be caused by their unnecessary loss or disturbance.

### **3.03 PREPARATION OF BED**

- A. As soon as excavation has been completed to proper depth as shown on the Utility Trench Detail, a layer of bedding material shall be placed and compacted to the elevation necessary to bring the pipe to grade.
- B. The compacted bed shall be rounded so that at least the bottom quadrant of the pipe shall rest firmly for the full length of the barrel. Suitable holes for bells or couplings shall be dug around the pipe joints to provide ample space for making tight joints.
- C. It shall be the Contractor's responsibility to control any water in the trench below the pipe invert and he shall place concrete, clay or other impermeable material in the bedding at one hundred (100) foot intervals to prevent horizontal movement of the groundwater which might induce settling of the bed, or make it difficult to handle water in the trench.

### **3.04 LAYING PIPE**

- A. Each pipe length shall be inspected for cracks, defects in coating or lining and any other evidences of unsuitability. Before lowering in-place, the pipe shall be struck with a suitable tool to verify its soundness.
- B. Pipe shall be laid in the dry and at no time shall water in the trench be permitted to flow into the sewer.
- C. The pipe shall then be laid on the trench bedding as shown on the Utility Trench Detail and the spigot pushed home. Jointing shall be in accordance with the manufacturers' instructions and

appropriate ASTM Standards and the Contractor shall have on hand for each pipe laying crew, the necessary tools, gauges, pipe cutters, etc., necessary to install the pipe in a workmanlike manner. Pipe laying shall proceed upgrade with spigot ends pointing in the direction of the flow.

- D. Blocking under the pipe will not be permitted except where a concrete cradle is proposed in which case precast concrete blocks shall be used.
- E. After the pipe has been set to grade, additional bedding material shall be placed in six (6) inch layers up to the springline of the pipe. Tamping bars shall be carefully employed to assure compaction of the bedding under the lower quadrants of the pipe.
- F. At this point, the pipe shall be checked for line and grade and any debris, tools, etc. shall be removed.
- G. After this, the sand borrow shall be carefully placed in six (6) inch layers to a depth of twelve (12) inches over the crown of the pipe. Each layer shall be thoroughly compacted with mechanical equipment. Care shall be taken that the equipment does not damage the pipe.
- H. If inspection of the pipe is satisfactory, the Contractor may then refill or backfill the remainder of the trench in accordance with the Sewer Trench Detail.
- I. At any time that work is not in progress, the end of the pipe shall be closed with a PVC plug supplied by the pipe manufacturer to prevent the entry of animals, earth, water etc.
- J. At the end of each days' work or at intervals of no more than 100 feet of pipe, the Owner's Representative, with the Contractor, will inspect the pipe for alignment with lamps or mirrors. Unsatisfactory work shall be dug up and reinstalled to the satisfaction of the Owner's Representative.

### **3.05 TESTING**

#### **A. Leakage Tests:**

- 1. All portions of all sewers shall be subjected to leakage tests under the direction of the City of Portsmouth. The Contractor shall have on hand, all plugs, pumps, etc. necessary to conduct the test. Should the work fail the leakage test, corrective action shall be taken by the Contractor in a manner approved by the City of Portsmouth. If directed by the City of Portsmouth, all portions of the section tested shall be dug up and re-laid.
- 2. In general, the use of sealants, applied from the inside of the pipe, will not be approved.
- 3. All gravity sewer shall be air tested, unless other methods have been approved by the town. Tests should be completed in accordance with Choose One - MDEP, MEDEP, RIDEM. CTDEP or NHDES Standards and ASTM C828. Each section of pipe shall meet the above criteria.

#### **B. Testing limits and test gauge diameter for plastic pipe:**

- 1. Acceptance limit for deflection tests of installed flexible sewer pipe shall be 7-1/2% of average inside diameter. A test shall be conducted after a minimum of thirty days following installation.
- 2. The deflection gauge diameter (G) for this test shall be determined by the following formula:  
$$G = .925 D \text{ inches (nominal)}$$
where D is the average inside diameter given in the applicable ASTM standard.
- 3. 100% of the pipe shall be tested for deflection.
- 4. Deflection shall not exceed these standards for any pipe length.

## **PART 4.0 - CONNECTIONS TO EXISTING SEWERS AND MANHOLES**

### **4.01 GENERAL**

- A. The Contractor shall make all connections to the existing facilities as indicated on the drawings and as herein specified, or as directed.
- B. The Contractor shall furnish all pipe, fittings and appurtenances. The Contractor shall do all excavation and backfill as required.
- C. Existing pipeline damaged by the Contractor shall be replaced by him at his own expense in a manner approved by the City of Portsmouth.

### **4.02 INTERFERENCE**

- A. The Contractor shall develop a program for the construction and placing in service of the new works subject to the approval of the City of Portsmouth. All work involving cutting into and connecting to the existing facilities shall be planned so as to interfere with operation of the existing facilities for the shortest possible time and when the demands on the system best permit such interference even to the extent of working outside of normal working hours to meet these requirements.
- B. The Contractor shall have all possible preparatory work done and shall provide all labor, tools, material and equipment required to do the work in one continuous operation.

#### **4.03 NORMAL JOINT CONNECTIONS**

- A. The Contractor shall make joint connections similar to those on the existing pipe or adaptable to such pipe unless specifically otherwise shown on the drawings or directed by the City of Portsmouth.

#### **4.04 CONNECTION TO EXISTING SEWERS AND MANHOLES**

- A. Public Sewers:
  - 1. Where new construction is intended to connect to an existing sewer special care shall be taken to insure a tight joint between the new and existing sewers.
- B. Service Connections:
  - 1. Service connections constructed where there is no connection fitting or where the fitting has been damaged by or cannot be located by the Contractor shall be constructed of cast iron saddles. Service connections made on existing reinforced concrete sewer pipes shall use a Kor-N-Seal type boot, installed after tapping the hole.
  - 2. Existing sewers shall be tapped by mechanical tapping machines specifically designed for such work. Tapping by use of hammer and chisel shall not be allowed except if specifically authorized in writing by the town.
- C. Manholes:
  - 1. Where new construction is intended to connect to an existing brick or block manhole, the existing manhole shall be replaced. If the existing manhole is of concrete or precast concrete and in satisfactory condition as determined by the City of Portsmouth, this requirement may be waived by the City of Portsmouth. For connections to existing concrete or precast concrete manholes, a hole shall be mechanically cored and a Kor-N-Seal type rubber boot installed, to provide a watertight connection.

### **PART 5.0 - PROXIMITY TO WATER MAINS**

- 5.01** Ten (10) feet horizontal separation between sanitary sewers and water lines is required. However, should construction operations reveal or expose a water line (main or service) running approximately parallel to and less than ten (10) feet horizontally from the proposed sewer installation and where it is not practicable to relocate the sewer, the following methods of protection must be employed:
  - A. Sewer pipe shall be Class 52 ductile iron for a maximum distance of 75 feet each side of the area where separation cannot be met.
  - B. Joints shall be mechanical type water pressure rated with zero leakage when tested at 25 pounds per square inch for gravity sewers.
  - C. Hardware for mechanical joints shall be stainless steel.
- 5.02** Whenever sewers must cross water mains, the sewer shall be constructed as follows:
  - A. Vertical separation of the sewer and water main shall not be less than 18".
  - B. Sewer pipe shall be PVC Class 150 conforming to AWWA Specification C900 for a minimum distance of nine (9) feet each side of the crossing and encased in MHD 3000 psi concrete (Type II cement).
  - C. Water pipe shall be centered over crossing with sewer to obtain maximum distance between joints.

**END OF SECTION**

**SECTION 02 75 00  
STORM DRAINAGE****PART 1.0 - GENERAL****1.01 REFERENCES**

- A. Refer to other divisions of these specifications, other sections in this division, and drawings for related work, which may affect the work of this section.
- B. The Contract Drawings indicate and show limits of construction for this project. These specifications specify material and work requirements for this project. Both are complementary to each other, and both shall be followed to properly complete the work.

**1.02 SCOPE OF WORK**

- A. Without limiting the generality thereof, the work under this section consists of furnishing all labor, equipment, supplies, services and materials and performing all operations in connection with the installation of the storm drainage system, including piping, pipe end sections, catchbasins, outlet structures and connection to building roof drains, and all related work required for the storm drainage system as indicated on the drawings and as specified herein.

**1.03 RELATED WORK IN OTHER SECTIONS**

- A. The following is a list of related work items that are specified or included under Sections of these Specifications as indicated.
  - 1. Section 02 20 20 – Site Earthwork.

**1.04 LAWS AND REGULATIONS**

- A. All work shall be accomplished in accordance with regulations of local, county and state agencies as they apply.
- B. Secure all necessary permits from municipal, county and state departments having jurisdiction prior to the start of construction and furnish proof of acceptance upon completion of the work.

**1.05 GRADES AND ELEVATIONS**

- A. The drawings indicate the alignment, invert and finished grade elevations of all structures and utilities. The Owner's Representative, however, may make such adjustments in grades and alignment as are found necessary in order to avoid interference and to adapt the utilities and piping to other special conditions encountered.

**1.06 SUBMITTALS**

- A. Submit shop drawings for all storm drainage items (piping, structures, etc.) described or indicated on the drawings for approval prior to ordering.

**PART 2.0 - PRODUCTS****2.01 PRODUCTS**

- A. Piping for site drainage work shall be of the following materials:
  - 1. Reinforced Concrete Pipe
    - a. This pipe shall conform to the requirements of AASHTO M170, except as follows: Wall A thickness will be allowed in Class III pipe only. When the plans call for reinforced concrete pipe capable of withstanding an ultimate load greater than 3750D, the design requirements of Class V shall be met with further provision that the pipe will withstand the ultimate D load of a 4,000 D.
    - b. Basis of acceptance of concrete pipe shall conform to AASHTO M170, Section 5.1.1 Test requirements shall be as provided in Section 10.3.1 and 10.5 with the further provision that the pipe will withstand an additional ten (10) percent of the D load specified or brought to destruction. Permissible variation in pipe tolerances shall conform to AASHTO M170, Section 11.



Table 1 - Minimum Strength Requirements

<u>D-Load to Produce the Ultimate Load = Class</u>	<u>D-Load to Produce a 0.01 inch Crack</u>	<u>AASHTO Designation Class</u>
1,500 D	1,000	II
2,000 D	1,350	III
3,000 D	2,000	IV
3,750 D	3,000	V
4,000 D	-	-

- c. Unless a different class is specified on the plans, reinforced concrete pipe shall meet the requirements of AASHTO Class III designations.
- d. Workmanship and finish shall conform to AASHTO M170, Section 12. Pipe shall be subject to rejection on account of failure to conform to any of the specification requirements of AASHTO M170, section 15.
- e. Markings on pipe shall conform to AASHTO M170, Section 16.
- f. Joints shall conform to AASHTO M198, flexible watertight gaskets.
- 2. Polyethylene Pipe
  - a. The products supplied under this specification shall be high density polyethylene corrugated exterior/smooth interior pipe. Four through ten inch diameters shall meet all requirements of AASHTO M252 with the addition that the pipe have a smooth interior liner. Twelve to thirty-six inch diameters shall conform to AASHTO M204 Type S. Forty-two and forty-eight inch diameters shall have minimum pipe stiffness of 20 and 17 psi, respectively, at 5% deflection; and shall meet all other requirements of AASHTO M294.
- 3. Polyvinyl Chloride (PVC)
  - a. PVC pipe shall meet the requirements of ASTM D 3034, SDR 35 for gasketed joints, ASTM F 477.
- B. Drainage Structures
  - 1. Precast Concrete Manholes
    - a. ASTM C 478, ASTM C 913 & ASTM C 890 where applicable for heavy-traffic, ASHTO HS 20-44 structural loading; of depth, shape and dimensions indicated, with provision for rubber gasketed joints.
    - b. Diameter: 48-inches minimum, unless otherwise indicated on the drawings.
    - c. Ballast: Increased thickness or precast concrete sections or added concrete to base section may be required to prevent floatation due to high groundwater. Engineer to be notified immediately prior to installation of structure(s)
    - d. Gasket: Buytl Rubber.
    - e. Steps: ASTM C 478, Steel reinforced copolymer polypropylene plastic drop front type as manufactured by M.A. Industries, Inc. or approved equal. Include pattern designed to prevent lateral slippage off step. Cast or anchor into sidewalls with steps at twelve (12) inch intervals.
    - f. Pipe Connectors: Non-shrink grout shall be supplied at all pipe connections.
    - g. In lieu of a cone section, when manhole depth is less than 6 feet, a reinforced concrete slab cover may be used having an eccentric entrance opening and capable of supporting H-20 loads.
  - 2. Manhole Frames and Covers
    - a. Manhole frames and covers shall conform to the details.
    - b. ASTM A 48, Class 30B gray iron castings.
    - c. LeBaron Foundry, Inc., or approved equal.
    - d. Top design with three (3) inch minimum lettering with "DRAIN" cast into cover.

- e. The castings shall be of good quality, heavy duty, strong, tough, even-rained cast iron, smooth, free from scale, lumps, blisters, sandholes and defects of every nature which would render them unfit for the service for which they are intended. Contact surfaces of covers and frame seats shall be machined at the foundry, before shipment to prevent rocking of covers in any orientation.
- f. All castings shall be thoroughly cleaned and subject to a careful hammer inspections.
- 3. Precast Concrete Catch Basins
  - a. ASTM C 478, ASTM C 913 & ASTM C 890 where applicable for heavy-traffic, AASHTO HS 20-44 structural loading; of depth, shape and dimensions indicated, with provision for rubber gasketed joints.
  - b. Diameter: 48-inches minimum, unless otherwise indicated on the drawings.
  - c. Ballast: Increased thickness or precast concrete sections or added concrete to base section may be required to prevent floatation due to high groundwater. Engineer to be notified immediately prior to installation of structure(s).
  - d. Base Section: Thickness for floor slab and walls as required.
  - e. Gasket: Buytl rubber.
  - f. Oil and Gas Hoods: Best Management Products, Inc. "The Snout".
  - g. Pipe Connectors: Non-shrink grout shall be supplied at all pipe connections.
  - h. In lieu of a cone section, when manhole depth is less than 6 feet, a reinforced concrete slab cover may be used having an eccentric entrance opening and capable of supporting H-20 loads.
- 4. Frame and Grates: ASTM A 48, Class 30B gray-iron castings.  
LeBaron Foundry, Inc. Catalog Number LF248-2 for single and LV2448-2 for double or approved equal.
- C. Pipe Outlets
  - 1. Flared Ends: Manufacturer's standard flared end section constructed of corrugated metal or concrete (note no PVC or NDPE), refer to drawings.
  - 2. Riprap Apron: Broken, irregular size and shape, graded stone as indicated on the drawings.
- D. Miscellaneous Brickwork
  - 1. This section applies to brick masonry, for the shelf and grade adjustment.
  - 2. The brick shall be sound, hard, and uniformly burned brick, regular and uniform in shape and size, of compact texture, and satisfactory to the Owner's Representative. Brick shall comply with the ASTM Standard Specifications for Sewer Brick (made from clay or shale), Designation C32, for Grade MA and SA. Underburned cement or salmon brick is not acceptable. Use only whole brick.
  - 3. Rejected brick shall be immediately removed from the site by the contractor at its own expense.
  - 4. The mortar shall be composed of Portland Cement, hydrated lime and sand, in the proportions of one (1) part cement, half (1/2) part lime and four and a half (4 1/2) parts sand (by volume). The proportion of cement to lime may vary from 1:1/4 for hard brick to 1:3/4 for softer brick, but in no case shall the volume of sand exceed three (3) times the sum of the volume of cement and lime. Mortar shall conform to ASTM C 270. Approximate measurement of quantities and antifreeze mixtures are not permitted.
  - 5. Cement shall be Type II Portland Cement conforming to ASTM C 150, for Portland Cement.
  - 6. The hydrated lime shall be Type S conforming to the ASTM Standard Specifications for Hydrated Lime for Masonry Purposes, Designation C 207.
  - 7. The sand shall be clean, hard, sharp, durable particles, preferably siliceous consisting of inert natural sand with not more than five (5) percent in volume of loam, mica, clay, or other deleterious substances, and free from organic matter, graded from fine to coarse conforming to the ASTM Standard Specifications for Masonry Mortar, Designations C 144.
  - 8. Only clean bricks shall be used in brickwork for manholes. The brick shall be moistened by suitable means, as directed, until they are neither so dry as to absorb water from the mortar nor so wet as to be slippery when laid.
  - 9. Each brick shall be laid in full bed and joint of mortar without requiring subsequent grouting,

- flushing or filling, and shall be thoroughly bonded as directed.
10. Brick masonry shall be protected from rapid drying by the use of burlap kept moist, or by other approved means and shall be protected from the weather and frost.
  11. Water shall be clean and fresh, free from injurious amounts of oils, acids, alkalis, or organic matter.

## **PART 3.0 - EXECUTION**

### **3.01 CONSTRUCTION**

- A. General Installation
  1. Drawings, 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 practicable.
  2. Install piping 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. Maintain swab or drag in line, and pull past each joint as it is completed.
  3. Construct at least one (1) impervious dam of clay or concrete in the pipe bedding material every three-hundred (300) feet to interrupt the unnatural flow of groundwater after construction is completed. The height of the impervious dam shall extend from the bottom of the bedding to the top of the pipe.
  4. Use manholes for changes in direction, unless otherwise directed.
  5. Use 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.
  6. Extend storm drainage piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.
  7. Align manhole step offset from any drop inlets.
- B. Site and Trench Excavation, Fill and Backfill
  1. Perform all pavement replacement, repair and patching, as specified under bituminous pavement sawcut and patch.
  2. Trench widths shall be sufficient to permit proper installation of the work, and bottoms of trenches shall be evenly graded. The maximum allowable width of trench for pipe shall be as indicated on the details. Excavations below required depths shall be refilled with crushed stone and compacted. Immediately after trench excavations have been carried to the required grades, the exposed surface of the existing bottom shall be cleaned of all loose disturbed materials. Where the trench bottom is below the water level or within saturated earth materials, bedding below the storm drain shall be made with a minimum of 12 inches of crushed stone. Pipe beds in bedding material shall be rounded to accommodate the bottom quadrant of the pipe and to provide full support and uniform bearing for the entire length of the pipe barrel.
  3. Control and pitch the grading to prevent water from running into the excavated areas of the site or drain, or to prevent damage to other structures or work already accomplished.
  4. Furnish all pumping and other dewatering equipment necessary to keep excavated areas dry during construction. Water shall not be conducted onto adjacent property except in existing water courses.
  5. After piping and structures have been installed, tested, inspected and approved by the Owner's Representative, crushed stone bedding material as specified shall be carefully hand placed and hand tamped in 6 inch layers, under, around and to the spring line of the pipe. After this, the sand blanket shall be carefully placed in six inch layers to a level 1 foot above the top of the piping. The remaining excavation shall be backfilled with approved backfill materials, compacted in 1 foot layers loose measure. Backfill shall be compacted to not less than 95 percent of the ASTM maximum dry densities as specified herein.
  6. Obtain information from proper authorities concerning locations of existing utilities within the scope of this work in order to avoid damage to such utilities. The Owner will not be responsible for any such damage. Restore any structure and repair any resultant damage without additional

cost to the Owner.

7. Rules and regulations governing the respective utilities shall be observed. Active utilities shall be adequately protected from damage and shall not be removed or relocated except as indicated or directed. Inactive and abandoned utilities shall be reported in writing to the Owner's Representative and shall be removed, plugged or capped as directed.
  8. Excavations shall be adequately sheeted, shored and braced as necessary to permit proper execution of the work and to protect all slopes and earth banks. Sheet piling shall be installed if required to prevent cave-ins or settlement and to protect workmen, adjacent structures and utilities. Shoring and piling may be removed as the backfilling progresses, but only when banks are safe against caving.
  9. Excavation of earth, boulders of rock beyond indicated or authorized limits shall be refilled at no additional expense to the Owner with gravel compacted to 95 percent of the maximum dry density at optimum moisture content, or crushed stone, as required by the Owner's Representative.
- C. Drainage Structure Installation
1. Install structures, complete with appurtenances and accessories indicated.
  2. Set frames, covers and grates to elevations indicated on the drawings, unless otherwise indicated.
  3. Install gaskets according to ASTM C 891.
  4. Holes used for handling and laying of structure shall be tapered and plugged with hydraulic cement after installation.

### **3.02 FIELD QUALITY CONTROL**

- A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. In large, accessible piping, brushes and brooms may be used for cleaning. Place plug in end of incomplete piping at end of day and when work stops. Flush piping between manholes and other structures to remove collected debris.
- B. Inspect interior of piping and structures to determine whether line displacement or other damage has occurred. Inspect after approximately twenty-four (24) inches of backfill is in place and again at completion of project. Defects requiring correction include the following:
  1. For alignment, less than full diameter of inside pipe is visible between structures.
  2. Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
  3. Crushed, broken, cracked or otherwise damaged piping.
- C. Replace defective piping using new materials, and repeat inspections until defects are within tolerable allowances specified.
- D. Re-inspect and repeat procedure until results are satisfactory.

**END OF SECTION**

**SECTION 02 93 00  
LOAMING AND SEEDING**

**PART 1.0 - GENERAL**

**1.01 REFERENCES**

- A. Refer to other divisions of these specifications, other sections in this division, and drawings for related work, which may affect the work of this section.
- B. The Contract Drawings indicate and show limits of construction for this project. These specifications specify material and work requirements for this project. Both are complementary to each other, and both shall be followed to properly complete the work.
- C. All work shall be in compliance with the most current editions of the "Standard Specifications".

**1.02 SCOPE OF WORK**

- A. The Contractor shall furnish all labor, materials, tools and equipment necessary to prepare the subgrade, place and spread loam, fine grade loam; and soil conditioning, lime and fertilize, seed, water, and maintain and cut the grass cover.

**1.03 AREAS TO BE LOAMED AND SEEDED**

- A. Areas designated on the plans and as specified in the details.

**1.04 QUALITY ASSURANCE**

- A. A standard soil test shall be performed by a Soil and Plant Tissue Testing Laboratory for each distinct newly landscaped area where soil properties or use may differ; sampling locations shall be reviewed by the Owner. A turf establishment plan (including fertilization program) shall include the soil analyses results and shall incorporate the accompanying recommendations. Said plan shall be submitted to the Owner for approval in writing at least six (6) weeks prior to implementation.

**1.05 SUBMITTALS**

- A. A copy of the turf establishment plan shall be furnished to the Owner's Representative for approval at least six (6) weeks prior to any loaming and seeding.

**PART 2.0 - MATERIALS**

**2.01 LOAM**

- A. Loam shall consist of loose friable topsoil with no admixture of refuse or material toxic to plant growth. Loam shall be generally free from stones, lumps, stumps, or similar objects larger than 1 inch in greatest diameter or length, subsoil, roots, and weeds. The term as used herein shall mean that portion of the soil profile defined technically as the "A" horizon by the Soil Science Society of America. The minimum and maximum pH value shall be from 5.5 to 7.6. Loam shall contain a minimum of 3 percent and a maximum of 10 percent of organic matter as determined by loss by ignition. Not more than 65 percent shall pass a No. 200 sieve as determined by the wash test in accordance with ASTM D 1140. In no instance shall more than 20% of that material passing the No. 4 sieve consist of clay size particles.

**2.02 SOIL CONDITIONERS AND FERTILIZER**

- A. Soil conditioning and fertilizing material shall be of the recommended kinds and from acceptable sources.
- B. Lime shall be applied at the minimum rate of 3 tons per acre or more if recommended by the County Agricultural Agent based on soils analysis.

**2.03 SEED**

- A. A grass seed mixture containing the following seed requirements shall be used.

<b>General Cover</b>	<u>Pounds/Acre</u>
Creeping Red Fescue <sup>b</sup>	50
Kentucky Blue Grass <sup>a</sup>	100
<b>Slope Seed (used on all slopes greater than or equal to 3:1)</b>	
Creeping Red Fescue <sup>b</sup>	20
Tall Fescue	20
<sup>a</sup> Bluegrass shall be a certified variety such as Merion, Baron, Majestic Touchdown, Nugget, Ram One, or equal.	<u>2</u>
<sup>b</sup> Fescue varieties shall include – Creeping Red and/or Hard Reliant, Scaldis, Koket, or Jamestown.	42

- B. For temporary protection of disturbed areas, seed shall be applied at the following rates:

Annual Rye	40 lbs/Acre
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- C. In no case shall the weed content exceed one (1) percent by weight. All seed shall comply with state and federal seed laws.

## **PART 3.0 - EXECUTION**

### **3.01 PREPARATION FOR SEEDING**

- A. Finish Grading
1. After rough grading of the subgrade has been completed and approved, the subgrade surface shall be scarified to a depth of four (4) inches. Then furnish and install a layer of loam providing a rolled four inch thickness. Any depressions, which may occur during rolling, shall be filled with additional loam, regraded and rerolled until the surface is true to the finished lines and grades. All loam necessary to complete the work under this section shall be supplied by the Contractor.
  2. All large stiff clods, lumps, brush, roots, debris, glass, stumps, litter, and other foreign material as well as stones over one (1) inch in diameter or length shall be removed from the loam and disposed of off site.
  3. The loam shall be prepared to receive seed by removing stones and grading to eliminate water pockets and irregularities prior to placing seed. Finish grading shall result in straight uniform grades and smooth, even surfaces without irregularities to low points.
  4. All stones over one-half (½) inch in diameter remaining on the surface after raking shall be removed.
  5. Shape the areas to the lines and grades required. The Contractor's attention is directed to the scheduling of Loaming and Seeding of graded areas to permit sufficient time for the stabilization of these areas.
  6. All areas disturbed by construction within the property lines and not covered by structures, pavement, or bark mulch shall be loamed and seeded.
  7. Limestone shall be thoroughly incorporated into the loam layer in order to provide a pH value of 5.5 to 6.5.
  8. Fertilizer shall be spread on the top layer of loam at the rate of 500 pounds per acre and worked into the surface.

### **3.02 SOIL CONDITIONERS AND FERTILIZERS**

- A. Soil conditioners and fertilizer shall be applied at the recommended rates and shall be thoroughly worked into the loam. Loam shall be raked until the surface is finely pulverized, smooth and even, and then compacted to an even surface conforming to the required lines and grades with

approved rollers weighing between 4 1/2 pounds and 5 1/2 pounds per inch of width.

### **3.03 SEEDING**

- A. Seed shall be sown at the rates indicated above. Sowing shall be done on a calm, dry day. Immediately before seeding, the soil shall be lightly raked. One half the seed shall be sown in one direction and the other half at right angles to the original direction. It shall be lightly raked into the soil to a depth not over 1/4 inch and rolled with a hand roller weighing not over 100 pounds per linear foot of width.
  - 1. Hay mulch shall be applied immediately after seeding at a rate of 1.5 to 2 tons per acre. Mulch that blows or washes away shall be replaced immediately and anchored using appropriate techniques from the Stormwater Management Control Handbook for Urban and Developing Areas in New Hampshire.
  - 2. The surface shall be watered and kept moist with a fine spray as required, without washing away the soil, until the grass is well established. Any areas which are not satisfactorily covered with grass shall be reseeded, and all noxious weeds removed.
- B. Unless otherwise approved, seeding shall be done during the approximate periods of early Spring to May 20, and August 10 to September 15, when soil conditions and weather are suitable for such work.

### **3.04 TEMPORARY PLANTINGS**

- A. For temporary plantings after September to early Spring and for temporary protection of disturbed areas.
  - 1. Following above slope, loam depth and grading requirements.
  - 2. Fertilizer shall be spread and worked into the surface at a rate of 300 pounds per acre.
  - 3. Mulching shall be applied at the rate of 3 tons/acre.
  - 4. Follow above seeding rates and procedures.

### **3.05 MAINTENANCE AND PROTECTION**

- A. Maintenance shall include watering as specified, weeding, removal of stones and other foreign objects over one half (1/2) inch in diameter which may appear and the first two (2) cuttings of grass no closer than ten (10) days apart. The first cutting shall be accomplished when the grass is from 2 1/2 to 3 inches high. All bare or dead spots which become apparent shall be properly prepared, re-loamed, limed and fertilized, and reseeded as many times as necessary to secure a good growth. The entire area shall be maintained, watered and cut until final acceptance of the lawn installation.
- B. To be acceptable, seeded areas shall consist of a uniform stand of at least 90 percent established permanent grass species, with uniform count of at least 100 plants per square foot.
- C. The Owner's Representative shall determine whether maintenance shall continue in any part.
- D. After all necessary corrective work and clean-up has been completed, and maintenance instructions have been received by the Owner, the Owner's Representative will certify in writing the acceptance of the lawns.

**END OF SECTION**

**SECTION 03 30 00  
CAST-IN-PLACE CONCRETE**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of this section.
- B. Examine all other sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

**1.02 DESCRIPTION OF WORK:**

- A. Work included: Provide labor, materials, and equipment necessary to complete the work of this Section and, without limiting the generality thereof, furnish and include the following:
  - 1. The extent of cast-in-place concrete work is shown on drawings and includes (but not by way of limitation) formwork, reinforcing, cast-in-place concrete, accessories, finishing, and casting in of items specified under other Sections of the Specifications or furnished by Owner that are required to be built-in with the concrete.
  - 2. Equipment support pads indicated on mechanical drawings to be installed by the Building Contractor.
  - 3. Cast-in-place retaining walls, exterior slabs on grade and other concrete shown on site drawings.

**1.03 RELATED WORK:**

- A. Metal Fabrications: Section 05 12 00
  - 1. Expansion Anchors - Section 05 12 00
  - 2. Embedded Items - Section 05 12 00
- B. Anchor Bolts: Section 05 12 00
- C. Joint Sealants: Section 07 90 00
- D. Underslab Vapor Retarders/Wall Waterproofing: Division 7

**1.04 QUALITY ASSURANCE:**

- A. Codes and Standards: Comply with provisions of the latest edition of the following except where more stringent requirements are shown or specified:
  - 1. ACI "Manual of Concrete Practice".
  - 2. ACI 117 "Standard Specifications for Tolerances for Concrete Construction and Materials".
  - 3. ACI 211.1 "Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete."
  - 4. ACI 212.3R "Chemical Admixtures for Concrete."
  - 5. ACI 301 "Specifications for Structural Concrete for Buildings."
  - 6. ACI 302.1R "Guide for Concrete Floor and Slab Construction."
  - 7. ACI 304R "Guide for Measuring, Mixing, Transporting and Placing Concrete."
  - 8. ACI 304.2R "Placing Concrete by Pumping Methods."
  - 9. ACI 306 R "Cold Weather Concreting."
  - 10. ACI 308 "Standard Practice for Curing Concrete."
  - 11. ACI 309R "Guide for Consolidation of Concrete."
  - 12. ACI 315 "ACI Detailing Manual."
  - 13. ACI 318 "Building Code Requirements for Reinforced Concrete."
  - 14. ACI 347R "Guide to Formwork for Concrete."



15. Concrete Reinforcing Steel Institute, "Placing Reinforcing Bars."
  16. AISC "Code of Standard Practice for Steel Buildings and Bridges."
  17. "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).
- B. Materials and installed work may require testing and retesting, as directed by the Architect, at any time during progress of work. Allow free access to material stockpiles and facilities. Tests not specifically indicated to be done at Owner's expense, including retesting of rejected materials and installed work, shall be done at Contractor's expense.

#### 1.05 SUBMITTALS:

- A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with Division 1.
- B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.
- C. All submittals shall be reviewed and returned to the Architect within 10 working days.
- D. Incomplete submittals will not be reviewed.
- E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with.
- F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.
- G. Hardcopy Submittals: Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.
- H. Electronic Submittals:
  1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.
  2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.
  3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Bluebeam version 12 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.
  4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with. Electronic submittals without the Contractor's approval will be rejected and returned.
  5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.
- I. Product Data: Submit producer's or manufacturer's specifications and installation

instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

1. Reinforcement certified mill reports covering chemical and physical properties and yield strength.
  2. Patching products.
  3. Non-shrink grout.
  4. Curing compounds, where applicable.
  5. Admixtures.
  6. Expansion/Adhesive Anchors.
- J. Shop Drawings:
1. Shop Drawing Preparation: Electronic files of structural drawings will not be provided to the contractor for preparation of shop drawings. Reproduction of any portion of the Construction Documents for use as Shop drawings is prohibited. Shop drawings created from reproduced Construction Documents will be returned without review. Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with ACI 315, showing bar schedules, stirrup and tie spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required at openings through concrete elements. Include supplemental reinforcing and bar supports necessary to support reinforcing steel at proper location within forms or slabs.
    - a. Review of the shop drawings will be made for the size and arrangement of reinforcement. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility.
    - b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided all items listed prior. **Incomplete submittals will not be reviewed.**
- K. Mix designs: Submit all laboratory test reports and materials for each mix design listed within. Prepare mixes by the field experience method and/or trial mixtures per the requirements of chapter 5 of ACI 318. Include the calculation of average strength and standard deviation. **Proportioning by water cement ratio method will not be permitted.**
- L. Samples: Submit samples of materials as specified and as otherwise requested by Architect, including names, sources and descriptions.
- M. Curing Methods: Submit documentation of curing methods to be used for review. Account for anticipated project temperature ranges and conditions in curing methods.
- N. Contraction/Construction Joints: Submit plan indicating proposed location of contraction and construction joints in walls and slabs.
- O. Test Reports: Test reports shall be submitted to the Owner, Architect and Engineer within 48 hour after completion of each test.

## **PART 2 PRODUCTS**

### **2.01 FORM MATERIALS**

- A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.
1. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with piece bearing legible inspection trademark.
- B. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in

- C. finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- D. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

## **2.02 REINFORCING MATERIALS**

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers, and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use plastic, wire bar type supports or concrete block supports complying with CRSI recommendations, unless otherwise specified. Wood, clay brick and other unspecified devices are not acceptable.
  - 1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
  - 2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class I) or stainless steel protected (CRSI, Class 2).

## **2.03 CONCRETE MATERIALS**

- A. Single-Source Supplier: Ready-mix concrete shall be from one supplier unless specific written approval is received from the Structural Engineer.
- B. Portland Cement: ASTM C 150, Type I or Type II, unless otherwise approved Use one brand of cement throughout project, unless otherwise acceptable to Architect.
- C. Normal Weight Aggregates: ASTM C 33. Provide from a single source for exposed concrete. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite, or ochre which can cause stains on exposed concrete surfaces.
- D. Light Weight Aggregates: ASTM C 330.
- E. Water: Potable.
- F. Air-Entraining Admixture: ASTM C 260.
- G. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G containing not more than 1% chloride ions.
- H. Fiber reinforcement shall be Type III Synthetic Virgin Homopolymer Polypropylene Fibers conforming to ASTM C1116. Fiber reinforcing shall be added and distributed prior to incorporation of Super Plasticizer.
- I. Normal range water reducing admixture: ASTM C 494 Type A containing no calcium chloride.
- J. Accelerating Admixture: ASTM C 494, Type C or E.
- K. Blast Furnace Slag: ASTM C989
- L. Fly Ash: ASTM C618, Class C or F
- M. Calcium Chloride is not permitted.

## **2.04 RELATED MATERIALS**

- A. Underslab Vapor Retarder: Provide vapor retarder over prepared sub base. Refer to architectural drawings, geotechnical report and/or division 7 specifications for additional requirements and vapor retarder location.
- B. Non-Shrink Cement-based Grout: Provide grout consisting of pre-measured, prepackaged materials supplied by the manufacturer requiring only the addition of water. Manufacturer's instructions must be printed on the outside of each bag.
  - 1. Non-shrink: No shrinkage (0.0%) and a maximum 4.0% expansion when tested in accordance with ASTM C-827. No shrinkage (0.0%) and a maximum of 0.3% expansion in the hardened state when tested in accordance with CRD-C-621.
  - 2. Compressive strength: A minimum 28 day compressive strength of 5000 psi when

- tested in accordance with ASTM C-109.
- 3. Setting time: A minimum initial set time of 60 minutes when tested in accordance with ASTM C-191.
- 4. Composition: Shall not contain metallic particles or expansive cement.
- C. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M182, Class 2.
- D. Moisture-Retaining Cover: One of the following, complying with ANSI/ASTM C 171.
  - 1. Waterproof paper.
  - 2. Polyethylene film.
  - 3. Polyethylene-coated burlap.
- E. Liquid Membrane-Forming Curing Compound: Liquid type membrane forming curing compound complying with ASTM C 309, Type I, Class A unless other type acceptable to Architect. Curing compound shall not impair bonding of any material, including floor finishes, to be applied directly to the concrete. Demonstrate the non-impairment prior to use.
- F. Preformed Expansion Joint Formers:
  - 1. Bituminous Fiber Type, ASTM D 1751.
  - 2. Felt Void, Poly-Styrene Cap with removable top as manufactured by SUPERIOR.
- G. Slab Joint Filler: Multi-component polyurethane sealant (self-leveling type).
- H. Waterstops shall be Bentonite/Butyl Rubberbased product. Use in conjunction with manufacturer's approved mastic. Acceptable products include:
  - 1. "Waterstop Rx," by American Colloid Co.
  - 2. "Adeka Ultra Seal MC-2010," by Asahi Denka Koeoyo, Kik MN.

## 2.05 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 318. Use material, including all admixtures, proposed for use on the project. If trial batch method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.
- B. Submit written reports to Architect of each proposed mix for each class of concrete. Do not begin concrete production until mixes have been reviewed by Architect.
- C. Proportion design mixes to provide concrete with the following properties:
  - 1. Footings and foundation walls:
    - a. Strength: 3,500 psi at 28 days.
    - b. Aggregate: 3/4"
    - c. W/C Ratio: 0.55 maximum
    - d. Entrained Air: 6% +/- 1.5%
    - e. Slump: 4" maximum
  - 2. Interior Slabs on grade:
    - a. Strength: 3,000 psi at 28 days
    - b. Aggregate: 3/4" minimum, 1 1/2" maximum.
    - c. W/C Ratio: 0.54 maximum
    - d. Entrapped Air only (no entrainment), 2.5% +/- 1%
    - e. Slump: 4" maximum
  - 3. Exterior Slabs and all other exposed Site Concrete not specified elsewhere:
    - a. Strength: 5,000 psi at 28 days
    - b. Aggregate: 3/4"
    - c. W/C Ratio: 0.40 maximum
    - d. Entrained Air: 6% +/- 1.5%
    - e. Slump: 4" maximum
  - 4. Add air entraining admixture at manufacturers prescribed rate to result in concrete

- at point of placement having the above noted air contents.
5. Additional slump may be achieved by the addition of a mid-range or high-range water reducing admixture. Maximum slump after the addition of admixture shall be 6 or 8 inches for mid-range or high range water reducing admixtures, respectively.
- D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor, when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Structural Engineer before using in work.
1. Water may be added at the project only if the maximum specified slump and design mix maximum water/cement ratio is not exceeded.
  2. Additional dosages of superplasticizer should be used when delays occur and required slump has not been maintained. A maximum of two additional dosages will be permitted per ACI 212.3R recommendations.

## **2.06 CONCRETE MIXING**

- A. Job-Site Mixing will not be permitted.
- B. Ready-Mix Concrete: Must comply with the requirements of ASTM C 94, and as herein specified. Provide batch ticket for each batch discharged and used in work, indicating project name, mix type, mix time and quantity.
  1. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required by Structural Engineer.
  2. When the air temperature is between 85 degrees F. and 90 degrees F., reduce the mixing and delivery time from 1 1/2 hours to 75 minutes, and when the air temperature is above 90 degrees F., reduce the mixing and delivery time to 60 minutes.

## **PART 3 EXECUTION**

### **3.01 FORMS**

- A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.
- B. Design, construct, erect, maintain, and remove forms for cast-in-place concrete work in compliance with ACI 347.
- C. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.
- D. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.
- E. Vertical dovetail slots may be required for masonry tie installation. Coordinate dovetail slot spacing and location with division 4 specifications and Architectural drawings.
- F. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, dovetail slots, reglets, recesses, and the like to prevent swelling and for easy removal.
- G. Provide temporary openings where interior area of formwork is inaccessible for clean out,

for inspection before concrete placement and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

- H. Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- I. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.
  - 1. Unless otherwise indicated, provide ties for concrete surfaces to be exposed to view in the final condition so portion remaining within concrete after removal is 1" (minimum) inside concrete.
  - 2. Form ties shall not leave holes larger than 1" diameter in concrete surface. Repair holes left by form ties after removal of formwork.
- J. Provision for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- K. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement as required to eliminate mortar leaks and maintain proper alignment.

### **3.02 PLACING REINFORCEMENT**

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
  - 1. Subgrade tolerance shall conform to a tolerance of  $\pm 1\frac{1}{2}$ ". Base tolerance (fine grading) for slabs shall conform to a tolerance of  $\pm 0\frac{3}{4}$ " in. Confirm compliance of above tolerances with surveyed measurements taken at 20 ft. intervals in each direction.
  - 2. Concrete reinforcing and/or welded wire fabric shown on structural drawings is provided for structural purposes only; additional reinforcement may be necessary for reinforcing support, the anchorage of structural embedded items, and the anchorage of non-structural embedded items including but not by limitation radiant tubing. This reinforcing is not shown on the structural drawings as it is part of the contractor's means and methods and shall be included at no cost to the Owner.
  - 3. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
  - 4. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.
  - 5. Place reinforcement to obtain specified coverage for concrete protection within tolerances of ACI-318. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

### **3.03 JOINTS:**

- A. Construction Joints: Locate and install construction joints, which are not shown on drawings, so as not to impair strength and appearance of the structure, as acceptable to Architect. Submit plan indicating proposed location of construction joints for review prior to beginning work.
  - 1. Provide keyways at least 1-1/2" deep in construction joints in walls, and slabs; bulkheads reviewed by the Engineer, designed for this purpose may be used for slabs.

2. Roughened surfaces shall be used between walls and footings unless shown otherwise on the drawings. The footing surface shall be roughened to at least an amplitude of 1/4" for the width of the wall before placing the wall concrete.
3. Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints.
4. Joints in slabs on grade shall be located and detailed as indicated on the drawings. If saw-cut joints are required, the early-entry dry-cut process shall be used. Refer to ACI 302, section 8.3.12.

#### **3.04 INSTALLATION OF EMBEDDED ITEMS:**

- A. General: Set, securely anchor and build into work prior to concrete placement all anchorage devices and all other embedded items, including but not by limitation reinforcement, reinforcing dowels, embedded plates, anchor rods, anchor inserts, sleeves, load transfer plates, diamond dowels and shelf bulk heads required for other work that is attached to, bear upon, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto. Notify other trades to permit installation of their work. Templates to be utilized for setting of anchorage devices shall be constructed in a manner to allow mechanical consolidation of concrete without disturbance. Embedments shall be placed in a timely fashion to permit the inspection of embedments prior to concrete placement. **"Wet Setting" of embedded items into plastic concrete is strictly prohibited.**
- B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface.
- C. Provide PVC sleeves where pipes and/or conduit pass through exterior concrete or slabs. Sleeves or penetrations shall not be placed through footings, piers, pedestals, drop caps, columns or pilasters unless specifically noted.
- D. Tolerances: Tolerances for Anchor Bolts/Rods, other embedded items and bearing surfaces shall meet the requirement set forth in the latest edition of the American Institute of Steel Construction "Code of Standard Practice for Steel Buildings and Bridges," and ACI 117. The more stringent criteria from these documents shall apply.

#### **3.05 INSTALLATION OF GROUT**

- A. Place grout for base plates in accordance with manufacturer's recommendations.
- B. Grout below setting plates as soon as practicable to facilitate erection of steel and prior to removal of temporary bracing and guys. If leveling bolts or shims are used for erection grout shall be installed prior to addition of any column load.
- C. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials and allow to cure. For proprietary grout materials, comply with manufacturer's instructions.

#### **3.06 PREPARATION OF FORM SURFACES:**

- A. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.
- B. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating material manufacturer's directions. Do not allow excess form coating to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

#### **3.07 CONCRETE PLACEMENT:**

- A. Preplacement Review: Footing bottoms are subject to review by the Geotechnical Engineer. Reinforcement and all concrete preparation work shall be subject to review by the Structural Engineer. Verify that reinforcing, ducts, anchors, seats, plates and other items cast into concrete are placed and securely held. Notify Engineer/Project Special

Inspector 48 hours prior to scheduled placement and obtain approval or waiver of review prior to placement. Be sure that all debris and foreign matter is removed from forms.

- B. Concrete shall be placed in the presence of an approved testing agency.
- C. General: Comply with ACI 304, and as herein specified.
  - 1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing.
  - 2. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients and in a manner which will assure that the required quality of the concrete is maintained.
  - 3. Conveying equipment shall be approved and shall be of a size and design such that detectable setting of concrete shall not occur before adjacent concrete is placed. Conveying equipment shall be cleaned at the end of each operation or work day. Conveying equipment and operations shall conform to the following additional requirements:
    - a. Belt conveyors shall be horizontal or at a slope which will not cause excessive segregation or loss of ingredients. Concrete shall be protected against undue drying or rise in temperature. An arrangement shall be used at the discharge end to prevent apparent segregation. Mortar shall not be allowed to adhere to the return length of the belt. Long runs shall be discharged into a hopper or through a baffle.
    - b. Chutes shall be metal or metal-lined and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 feet long, and chutes not meeting the slope requirements may be used provided they discharge into a hopper before distribution.
    - c. Pumping or pneumatic conveying equipment shall be of suitable kind with adequate pumping capacity. Pneumatic placement shall be controlled so that segregation is not apparent in the discharged concrete.
    - d. Concrete shall not be conveyed through pipe made of aluminum alloy. Standby equipment shall be provided on the site.
    - e. Tined rakes are prohibited as a means of conveying fiber reinforced concrete.
  - 4. Do not use reinforcement as bases for runways for concrete conveying equipment or other construction loads.
- D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 18 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
  - 1. Consolidate placed concrete by mechanical vibrating equipment. Hand-spading, rodding or tamping as the sole means for the consolidation of concrete will only be permitted with special permission from the Engineer. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
  - 2. Use vibrators designed to operate with vibratory equipment submerged in concrete, maintaining a speed of not less than 8000 impulses per minute and of sufficient amplitude to consolidate the concrete effectively. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine, generally at points 18 inches maximum apart. Place vibrators to rapidly penetrate placed layer and at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion maintain the duration of vibration for the time necessary to consolidate concrete and complete embedment of



- reinforcement and other embedded items without causing segregation of mix, generally from 5 to 15 seconds. A spare vibrator shall be kept on the job site during all concrete placing operation.
- E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is complete.
1. Consolidate concrete using internal vibrators during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations. Do not sprinkle water on plastic surface.
  3. Maintain reinforcing in proper position during concrete placement operations.
  4. Slab thicknesses indicated on the drawings are minimums. Provide sufficient concrete to account for structure deflection, subgrade fluctuations, and to obtain the specified slab elevation at the flatness and levelness indicated here within.
  5. Finish: See "Monolithic Slab Finishes" in this specification for slab finish requirements.
- F. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.
1. When air temperature has fallen to or is expected to fall below 40 degrees F (4 degrees C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C), and not more than 80 degrees F (27degrees C) at point of placement.
  2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  3. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators.
  4. All temporary heat, form insulation, insulated blankets, coverings, hay or other equipment and materials necessary to protect the concrete work from physical damage caused by frost , freezing action, or low temperature shall be provided prior to start of placing operations.
  5. When the air temperature has fallen to or is expected to fall below 40 degrees F, provide adequate means to maintain the temperature in the area where concrete is being placed between 50 and 70 degrees F.
- G. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.
  2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
  3. Wet forms thoroughly before placing concrete.
  4. Do not use retarding admixtures without the written acceptance by the Architect.

### **3.08 FINISH OF FORMED SURFACES:**

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

### **3.09 FLOOR FLATNESS AND LEVELNESS**

- A. Floor flatness/levelness tolerances: Tolerances for various floor uses shall conform to the requirements set forth in ACI 117 and ACI 302 for "flat" floor profile.
  - 1. Minimum Test Area Flatness/Levelness:  $F_F35/F_L25$
  - 2. Minimum Local F Number:  $F_F25/F_L15$
- B. Levelness criteria shall be applied to slabs-on-grade only.
- C. Contractor shall measure floor finish within 72 hours after slab finishing and provide corrective measures for finishes not within tolerance. Corrective procedures shall be reviewed by the Architect prior to implementation.

### **3.10 MONOLITHIC SLAB FINISHES:**

- A. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds, and as otherwise indicated.
  - 1. After placing slabs, plane surface to a tolerance not exceeding 1/2 in. in 10 ft. when tested with a 10-ft. straightedge. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms or rakes.
- B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, and as otherwise indicated.
- C. Trowel Finish: Apply trowel finish to monolithic slab surfaces indicated, including slab surfaces to be covered with carpet, resilient flooring, paint or other thin-film finish coating system.
- D. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.
- E. Slab finishes for floor coverings not indicated or exposed to view in the final condition shall be coordinated with the Architect prior to slab placement.
- F. Slab Joints: Where indicated, sawn slab contraction joints shall be "soft cut", immediately

after concrete surface is firm enough not to be torn or damaged by the blade.

### 3.11 CONCRETE CURING AND PROTECTION:

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 308 as herein specified.
- B. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof, as herein specified unless noted otherwise. Curing shall commence as soon as concrete surfaces are sufficiently hard as to withstand surface damage.
- C. Curing of Slabs-on Grade:
  - 1. Slabs-on-grade shall be cured by wet curing methods unless otherwise noted.
  - 2. Slabs-on-grade to receive floor coverings with moisture sensitive adhesives shall be cured by means of a moisture retaining covering. Coordinate curing with flooring adhesive manufacturer and flooring installer. Submit curing methods to Architect for review and approval.
  - 3. Slab-on Grade with Barrier 1 Admixture shall be cured by means of a moisture retaining covering in accordance with recommendations of Barrier 1 Admixture Manufacturer.
- D. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
- E. Protection From Mechanical Injury: During the curing period and duration of construction, the concrete shall be protected from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration. All finished concrete surfaces shall be protected from damage by construction equipment, materials, or methods, by application of curing procedures, and by rain or running water. Self-supporting structures shall not be loaded in such a way as to overstress the concrete.

### 3.12 REMOVAL OF FORMS:

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as joints, slabs and other structural elements, may not be removed in fewer than 14 days or until concrete has attained design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.
- C. Form facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and support.

### 3.13 REUSE OF FORMS:

- A. Clean and repair surfaces of forms to be reused 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 extended for successive concrete placement, thoroughly clean surfaces, remove fins and latency, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable

to Architect.

### **3.14 MISCELLANEOUS CONCRETE ITEMS:**

- A. Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

### **3.15 CONCRETE SURFACE REPAIRS:**

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to the Architect.
  - 1. Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush coat the area to be patched with approved bonding agent. Place patching mortar after bonding compound has dried.
  - 2. For exposed-to-view surfaces, 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.
- B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, form tie holes, cracks, spalls, air bubbles, honeycomb, rock pockets, fins, and other projections on surface and stains and other discolorations that cannot be removed by cleaning.

### **3.16 QUALITY CONTROL TESTING DURING CONSTRUCTION:**

- A. Testing Agency/Project Special Inspector shall verify reinforcement, including foundation reinforcement and slab reinforcement. Agent shall verify reinforcement has been chair/placed with proper clearances.
- B. The Owner shall employ a Testing Laboratory to inspect, sample and test the materials and the production of concrete and to submit test reports. Concrete testing shall be performed by technicians certified by the Maine Concrete Technician Certification Board and/or ACI Concrete Field Testing Technician Grade I.
- C. Concrete shall be sampled and tested for quality control during placement. Quality control testing shall include the following, unless otherwise directed by the Architect.
- D. See Submittals section for report requirements.
- E. Sampling Fresh Concrete: ASTM C 172.
  - 1. Slump: ASTM C143; one test for each set of compressive strength test specimens. Sample shall be taken from middle third of the load per ASTM C172. A slump test must be run prior to the incorporation of the CFP fibers per recommendations of ACI 544. A slump test must be run prior to and following the addition of a water reducer (superplasticizer) per recommendations of ACI 301.
  - 2. Air Content: ASTM C231 "Pressure method for normal weight concrete." One test for each set of compressive strength specimens measured at point of discharge.
  - 3. Concrete Temperature: Per ASTM C-1064; One test each time a set of compression test specimens are made.
  - 4. Compression Test Specimen: ASTM C31; 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.
    - a. An insulated Cure Box for specimen curing shall be supplied by Testing Agency for initial curing as defined in ACI C31.

- b. Means of heating or cooling the Cure Box shall be provided by the Inspection Agency if required in order to maintain a temperature between 60 and 80 degrees F. Contractor shall provide an electrical source to the Testing Agency when required for temperature control.
  - c. A maximum-minimum thermometer shall be provided in the Cure Box by the Testing Agency to record the temperature range of the Cure Box during specimen curing. The Testing Agency shall record the maximum/minimum temperature of the Cure Box when transferring the specimens to the laboratory.
  - d. Test Specimens shall be moist cured.
  - e. Refer to ASTM C31 for additional requirements for Test Specimens.
- 5. Compressive Strength Tests: ASTM C39; one set for each 50 cu. yds. or fraction thereof, of each concrete class placed in any one day or for each 4,000 sq. ft. of surface area placed; 1 specimen tested at 7 days, 3 specimens tested at 28 days, 1 specimen retained in reserve for later testing if required.
- 6. Pumped concrete shall be tested at point of discharge per ACI 301.
- F. Additional Tests: The testing service 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. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods, as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

**END OF SECTION**

**SECTION 03 54 00  
CAST UNDERLAYMENT**

**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Liquid-applied self-leveling floor underlayment.

**1.02 REFERENCE STANDARDS**

- A. ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens) ; 2012.
- B. ASTM C348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars; 2014.
- C. ASTM C1708 - Standard Test Methods for Self-Leveling Mortars Containing Hydraulic Cements.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

**1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, environmental limitations, and installation instructions.
- C. Samples: Submit a range of 8" x 8" min size samples demonstrating variation of surface finish color and polish for selection.

**1.04 QUALITY ASSURANCE**

- A. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years of experience and approved by the manufacturer.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Keep dry and protect from direct sun exposure, freezing, and ambient temperature greater than 105 degrees F.

**1.06 FIELD CONDITIONS**

- A. Do not install underlayment until floor penetrations and peripheral work are complete.
- B. Maintain minimum ambient temperatures of 50 degrees F 24 hours before, during and 72 hours after installation of underlayment.
- C. During the curing process, ventilate spaces to remove excess moisture.

**PART 2 PRODUCTS****2.01 MATERIALS**

- A. Cementitious Underlayment: Blended cement mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment.
  - 1. Compressive Strength, ASTM C1708, C109: Minimum 4000 psi after 28 days.
  - 2. Flexural Strength, ASTM C1708, C348: Minimum 900 psi after 28 days.
  - 3. Tensile Bond Strength, ASTM C1583: 300 PSI
  - 4. Density: 125 lb/cu ft, nominal.
  - 5. Final Set Time: 1-1/2 to 3 hours, maximum.
  - 6. Thickness: Capable of thicknesses from feather edge to maximum 3-1/2 inch.
  - 7. Surface Burning Characteristics, ASTM E84: Flame Spread Index 0, Smoke Developed Index 0.
  - 8. Products:
    - a. Ardex K15 by Ardex Engineered Cements.

- b. Koster SL Premium Self-Leveling Underlayment by Koster.
  - c. Laticrete Supercap by Laticrete LLC.
  - d. Standard SLU by Chapco, a division of H.B. Fuller.
  - e. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Aggregate: Dry, well graded, washed silica aggregate, approximately 1/8 inch in size and acceptable to underlayment manufacturer.
- C. Water: Potable and not detrimental to underlayment mix materials.
- D. Primer: Manufacturer's recommended type.
- E. Joint and Crack Filler: Latex based filler, as recommended by manufacturer.

## **2.02 MIXING**

- A. Site mix materials in accordance with manufacturer's instructions.
- B. Mix to self-leveling consistency without over-watering.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that underlayment is compatible with scheduled floor covering and adhesives.
- B. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate. Do not use acid or mastic removers on any surface. Surfaces shall be 50 degrees F, minimum and 90 degrees F maximum.

### **3.02 CEMENTITIOUS UNDERLAYMENT PREPARATION**

- A. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.
- B. Vacuum clean surfaces.
- C. Concrete: Mechanically prepare steel troweled concrete to create a textured surface necessary to achieve the best bond; acceptable methods include bead blasting and scarifying. Do not use acid etching.
- D. Close floor openings.
- E. Non-moving Crack Preparation: Thoroughly clean and chase cracks and saw-cuts. Fill with specified product.
- F. Working Cracks: Install expansion - contraction joint assemblies or fill with sealants specified for high movement joints as specified in Section 07 90 05 - Sealants.
- G. Prime substrate if recommended by the manufacturer in accordance with manufacturer's instructions. Allow to dry.

### **3.03 APPLICATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Pump or pour material onto substrate. Do not retemper or add water.
  - 1. Pump, move, and screed while the material is still highly flowable.
  - 2. Be careful not to create cold joints.
  - 3. Wear spiked shoes while working in the wet material to avoid leaving marks.
- C. Place to indicated floor elevation, achieving a minimum 1/8 inch thickness, with top surface level to 1/8 inch in 10 ft.
- D. If a fine, feathered edge is desired, steel trowel the edge after initial set, but before it is completely hard.

### **3.04 CURING**

- A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.
- B. Air cure in accordance with manufacturer's instructions.

### **3.05 FIELD QUALITY CONTROL**

- A. Field flow tests shall be performed by the Contractor periodically to ensure mix is homogeneous and free from separation.

**3.06 PROTECTION**

- A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.
- B. Do not permit traffic over unprotected floor underlayment surfaces.

**END OF SECTION**



**SECTION 03 93 00  
CONCRETE SLAB REHABILITATION**

**PART 1 – GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.02 SUMMARY**

- A. This Section includes the following:
  - 1. Patching and rebuilding of slab depressions and areas requiring repair due to demolition removals.
    - a. Filling thick set tile removal locations scheduled to receive resilient flooring.
  - 2. Leveling of concrete slab where required for proper installation of new flooring.
- B. Related Sections:
  - 1. Division 09 Section "Resilient Flooring" for floor system to be applied over floor patch infill.
  - 2. Division 09 Section "Flocked Flooring" for floor system to be applied over other repairs.

**1.03 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials to Project site in manufacturer's original and unopened containers and labeled with type and name of products and manufacturers.
- B. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.
- C. Store cementitious materials off the ground, under cover, and in a dry location.
- D. Store aggregates covered and in a dry location where grading and other required characteristics can be maintained and contamination avoided.

**PART 2 – PRODUCTS****2.01 MATERIALS – CONCRETE SLAB RESTORATION**

- A. Patching Material - Beneath new resilient flooring: Subject to compliance with requirements, polymer modified, cement based, fast setting, repair products that may be incorporated into the Work:
  - 1. ARDEX, Inc.: SDT.
- B. Primer: Ardex P 51 Primer.
- C. Coarse Aggregate for Adding to Patching Material – Deep Applications: Washed aggregate complying with ASTM C 33, Size No. 8, Class 5S. Add only as recommended by patching material manufacturer.
- D. Replacement of floor slab over trenches where floor slab has been completely removed and schedule allows specified cure period for concrete and drying time to permit floor covering installation.
  - 1. First lift: Patching material blended with coarse aggregate to within 1/4 inch of required slab elevation.
  - 2. Second Lift: Finish area to required elevation with slab with patching material.

### **PART 3 – EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that concrete slabs are dry and free of materials that would interfere with bonding of leveling and patching material.
- B. Report conditions outside of parameters recommended by manufacturer and other unacceptable conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

#### **3.02 PREPARATION**

- A. Prepare surface to receive patching and leveling materials in accordance with Manufacturer's written requirements.
- B. Mix materials in accordance with manufacturer's written instructions. Measure materials using buckets or other suitable measuring container.
  - 1. Blend aggregate for deep fills into patching material as recommended by the manufacturer.

#### **3.03 INSTALLATION**

- A. Patching Material, First Lift:
  - 1. Prime slab surface with two coats of primer per manufacturer's directions. Place material in continuous operation to bring the floor slab to within approximately 1/4 inch of required slab elevation.
- B. Patching Material, Second Lift: Prime first lift with two coats of primer per manufacturer's directions. Apply patching material to prepared first lift according to manufacturer's written instructions and as follows:
  - 1. Apply patching material underlayment to produce uniform, smooth surface, free of defects that would telegraph through resilient flooring system.
- C. Curing: Patching material shall cure for not less than 5 days after completion of installation before the application of new flooring.

**END OF SECTION**

**SECTION 04 20 00  
UNIT MASONRY****PART 1 GENERAL****1.01 SUMMARY**

- A. This Section includes unit masonry assemblies consisting of the following:
  - 1. Facing Brick
  - 2. Concrete masonry units (CMUs) for infill and patching.
  - 3. Mortar and grout.
  - 4. Masonry joint reinforcement.
  - 5. Building-in of lintels, bearing plates, anchors and items supplied by other trades
  - 6. Masonry waste disposal.

**1.02 RELATED SECTIONS**

- A. Section 0610 00 - Wood Blocking and Curbing: Nailers at masonry.
- B. Section 07 90 05 - Joint Sealers: Backing rod and sealant at control and expansion joints; compressible fillers at relieving angles.

**1.03 ADMINISTRATIVE REQUIREMENTS****1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, masonry accessories, and all other manufactured products.
- C. Shop Drawings:
  - 1. Submit shop drawings of all special masonry shapes. Shop drawings shall indicate types of materials, finishes, dimensions, and anchorage. Shapes shall be represented in plan, elevation, and related details.
  - 2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315
- D. Samples:
  - 1. Submit five samples of facing brick to illustrate color, texture, and extremes of color range.
  - 2. Submit samples of each type of reinforcement, ties, anchors, flashing, expansion joints, joint fillers, weeps, etc.
- E. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.
- F. Test Reports: Submit independent testing lab certificates:
  - 1. CMU with integral water repellent admixture.
  - 2. Mortar and grout mix designs and test results including proportions and mortar ingredients.
  - 3. Masonry units compression, absorption and measurement test result

**1.05 QUALITY ASSURANCE**

- A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.
- B. Pre-construction Testing: If manufacturer's published test reports are not available, the Contractor shall employ and pay an approved testing laboratory to perform pre-construction testing for:

1. Concrete unit masonry tests for each different unit for strength, absorption, and moisture content per ASTM C140 and fire-resistive tests per UL 618 and ACI 216.1/TMS 216.1.
2. Clay Unit Masonry Tests for each different unit per ASTM C67.
3. Prism tests for each type of wall construction per ASTM E447.
4. Mortar testing per ASTM C780.

#### **1.06 PROJECT CONDITIONS**

- A. hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.
  1. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.
- B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
  1. The maximum moisture content of concrete block when laid shall not exceed 30% for exterior exposures and 25% for interior exposures (as a percent of total absorption and is in addition to moisture level required under ASTM C90).
- B. All mortar materials shall be stored under cover in a dry place.
- C. Reinforcement steel, ties, and anchors shall be protected from the elements and, before being placed, shall be free from loose rust and other coating, including ice, that will destroy or reduce the bond.

### **PART 2 PRODUCTS**

#### **2.01 CONCRETE MASONRY UNITS**

- A. Concrete Masonry Units (CMU): ASTM C90. Normal weight, minimum average net area compressive strength 1,900 psi.
  1. Sizes and Shapes: Provide special shapes for lintels, corners, jambs, headers, bonding, and other special conditions.
  2. Provide bullnose units for outside corners, unless otherwise indicated.
  3. Provide solid units at all corbels, reveals lintels and where indicated on the Drawings.

#### **2.02 BRICK UNITS**

- A. Facing Brick: ASTM C 216, Type FBS, Grade SW.
  1. Size: manufactured to the following actual dimensions: Modular: 3-1/2 to 3-5/8 inches wide x 2-1/4 inches high x 7-1/2 to 7-5/8 inches long
  2. Special shapes: Molded and solid units as required by conditions indicated. All brick to be used to form outside corners shall be factory formed to provide return legs, as required to maintain a full running bond without clipped brick or mitered corners.
  3. Provide solid units at all corbels, reveals lintels, lip brick shapes and where indicated on the Drawings.
  4. Bonds: Running bond unless otherwise indicated on the Drawings.
  5. Efflorescence, ASTM C67: Not Effloresced.
  6. Initial Rate of Absorption, ASTM C67: Less than 20g per 30 sq. in/minute.
  7. Match existing brick in color, size and finish. Coordinate brick selection with architect.

8.

**2.03 BRICK MORTAR MATERIALS**

- A. Pre-mixed Masonry Cement: ASTM C270; ASTM C 91, Type N, commercially prepared type of Portland Cement Type 1 and hydrated lime Type N.
  - 1. Products:
    - a. Quik-crete, Type N Portland/Lime Blend.
    - b. Blue Circle.
    - c. Eagle Bond.
    - d. Substitutions: See Section 01 60 00 - Product Requirements.

**2.04 REINFORCEMENT AND ANCHORAGE**

- A. Single Strand Reinforcement: (For brick sills, soldier course and stack bond) Continuous single strand, hot dip galvanized to ASTM A153, Class B2, No. 9 gauge deformed wire.
- B. Masonry Veneer Anchors: 2-piece adjustable veneer anchor and pintel tie, stainless steel.
  - 1. Anchor Screws: Single screw veneer tie with dual diameter barrel and factory EPDM washers at both weather barrier and insulation faces. Barrel with 5/16" hex head, length to accommodate insulation.
    - a. Screw Type as recommended by manufacturer for substrate:
      - 1) Self Drilling Screw: Steel Stud
      - 2) Concrete/CMU Screw: Concrete or CMU
    - b. Barrel lengths as required for cavity applications indicated per the Drawings. Multiple lengths will be required.
  - 2. Adjustable Pintel Wire ties: Triangular shape, 3/16 inch thick minimum. Tie length shall be as required for a minimum 2" tie embedment in mortar.

**2.05 FLASHINGS**

- A. Drip Edge Flashing (for termination of membrane flashings at exterior face of masonry and to support membrane flashing across cavity voids): 0.024 inch Type 316 stainless steel continuous drip flashing, shape as indicated on the Drawings. Drip edge flashing shall extend into cavity void to support membrane thru-flashing.
  - 1. Vent Flashing provided by this Section shall be adhered to the top surface of drip flashing.
- B. Stainless Steel/Polymer Fabric Drainage Plane Flashing: ASTM A240/A240M stainless steel sheet bonded with rubber-based adhesive between one sheet of polymer fabric and one sheet of non-woven drainage material, with manufacturer's standard, self-adhering, stainless steel lap tape.
  - 1. Stainless steel: ASTM A240
  - 2. Fabrics:
    - a. Non-woven drainage fabric: Fabric laminated to front face stainless steel core.
  - 3. Mastic/sealant, outside & inside corners, end dams, splice materials, termination bars, weep vent protection, fasteners and other accessories as required for a complete system per manufacturer specifications.
  - 4. Manufacturers:
    - a. York Manufacturing, Inc ; Flash-Vent SS.
    - b. Substitutions: See Section 01 60 00 - Product Requirements.

**2.06 MASONRY CLEANERS**

- A. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate (Spic and Span) and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.

**2.07 ACCESSORIES**

- A. Cavity Drainage Material: Polyester strand mat fabric to prevent mortar droppings from clogging weeps, acts as an insect barrier while promoting air flow in the cavity wall.
  - 1. Product: Weep-Armor by York Manufacturing Inc.
  - 2. Alternates:

- a. Mortar Net USA, Ltd; Mortar Net with Insect Barrier.
  - b. Advanced Building Products Inc; Mortar Break DT.
  - c. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Drip Edge: Type 304 Stainless steel; 0.032 inch thickness; compatible with membrane and adhesives.
- C. Membrane Flashing Support: Stainless steel sheet; 0.012 inch thickness; to support flexible membrane flashings across cavities and other voids in construction.
- D. Termination Bars: Stainless steel; compatible with membrane and adhesives.
- E. Weep Holes and Cavity Vents: Polypropylene honeycomb, full joint height, color as selected by the Architect.
  - 1. Products:
    - a. Dur-O-Wal; Product DA 1006 Cell Vent.
    - b. Hohmann & Barnard, Inc; Product Quadrovent.
    - c. Mortar Net USA, Ltd; Mortar Net Weep Vents.
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
- G. Compressible Fillers: (Below relieving angles) See Section 07 90 05 - Joint Sealers.

## 2.08 CMU MORTAR AND GROUT MIXES

- A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold weather construction. Provide natural color unless otherwise indicated.
- B. Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified here within, combined with set-controlling admixtures to produce ready-mixed mortar complying with ASTM C1142.
- C. Aggregate for Mortar: ASTM C144, except for joints less than 1/4" thick, use aggregate graded with 100 percent passing No. 16 Sieve.
- D. Aggregate for Grout: ASTM C 404.
- E. Water: Clean and potable
- F. Additives: None permitted.
  - 1. Mortar for Unit Masonry: Job mixed mortar: Comply with ASTM C270, Proportion Specification for job mixed mortar
  - 2. Ready-mixed mortar: ASTM C 1142
  - 3. Masonry cement shall consist of portland-cement lime; mortar cement is acceptable, masonry cement is not acceptable.
  - 4. Mortar shall be Type S, unless otherwise noted.
  - 5. Mortar compressive stress when tested per ASTM C270 at 28-days shall be a minimum of 1,800 psi.
  - 6. Single Source for Mortar Units: Obtain mortar materials of uniform texture and color as specified from single manufacturer.
- G. Grout: Comply with ASTM C476

## 2.09 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A 615 Grade 60.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication.
- C. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.
  - 1 Hot-dip galvanized carbon steel.
  - 2 Wire Size for Side Rods: 3/16 gauge diameter.
  - 3 Wire Size for Cross Rods: 9 gauge diameter.
  - 4 Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.

- 5 Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- 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 roughing into masonry work.

#### **3.02 PREPARATION**

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.
- C. Steel sleeves shall be installed for all piping and cabling through masonry construction. Coordinate with Fire Protection, Plumbing, Mechanical and Electrical Divisions.
  - 1. Provide new sleeves for existing piping and cabling through new masonry work in renovations.

#### **3.03 PROTECTION OF WORK**

- A. During erection, all walls shall be kept dry by covering at the end of each day or shutdown period with a strong, waterproof membrane. Partially completed walls not being worked on shall be similarly protected at all times. Covering shall overhang walls at least 2' on each side, and shall be securely held in place.

#### **3.04 COLD AND HOT WEATHER REQUIREMENTS**

- A. Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.
- B. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- C. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

#### **3.05 COURSING, JOINTING AND BOND PATTERN**

- A. Establish lines, levels, and coursing to align with existing.
- B. All masonry work shall be properly coordinated as required to maintain aligned coursing throughout the building, unless specifically noted otherwise.
- C. Standard Concrete Masonry Units:
  - 1. Bond: Running bond with vertical joints in each course centered on units above and below
  - 2. Mortar Joints: Concave.
- D. Brick Units:
  - 1. Bond: Running bond unless otherwise indicated per the Drawings.
  - 2. Coursing: Three units and three mortar joints to equal 8 inches.
  - 3. Mortar Joints: Concave.
- E. Sealant Recesses: Outside joints around the perimeter of exterior door and window frames or

other wall openings shall be not less than 1/4" nor more than 3/8" wide, and shall be cleaned out to a uniform depth of at least 3/4" ready for placement of sealant by other trades.

### **3.06 PLACING AND BONDING**

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar and mortar smears as work progresses.
- E. Remove excess mortar promptly. Do not use acids, sandblasting or high-pressure cleaning methods.
- F. Interlock intersections and external corners.
- G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

### **3.07 CAVITY MORTAR CONTROL**

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

### **3.08 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER**

- B. Install horizontal joint reinforcement 16 inches on center.

Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

Place continuous joint reinforcement in first and second joint below top of walls.

- C. Lap joint reinforcement ends minimum 6 inches.
- D. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 16 inches on center horizontally, or at a maximum 1.77 sq ft of wall surface per anchor. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center and within 12 inches of openings and panel ends. Veneer ties (pintles) shall be embedded a minimum of 2" into the veneer mortar joints. All ties shall be properly sized to span the cavity.
- E. Reinforcement shall be so placed as to assure a 5/8" minimum mortar cover on the faces of walls.
- F. Seismic Reinforcement: Connect veneer anchors with continuous horizontal wire reinforcement before embedding anchors in mortar.
- G. Joint reinforcement for stack bonded soldier course masonry shall be installed continuously at all horizontal joints. Rods shall be lapped at least six (6) inches at splices. Reinforcement shall be placed as to assure 1/2" minimum mortar cover on the faces of walls.

### **3.09 REINFORCED UNIT MASONRY INSTALLATION**

- A. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.



- B. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
  - 1. Grout all cells with reinforcement.
  - 2. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
  - 2. Limit height of vertical grout pours to not more than 60 inches

### 3.10 MASONRY FLASHINGS

- A. Coordinate the installation of all flashings in masonry with Vent Flashings in this Section, to ensure that all required flashings divert water to the exterior of the building are installed.
- B. 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. Drip flashings shall extend from 1/8 inch beyond exterior face of masonry, across the cavity and turn up face of cavity wall surface at least 4 inches. Membrane flashing shall seal to weather barrier and lap over drip flashing and extend down to 1 inch into brick veneer on top of the drip flashing.
  - 2. Remove or cover protrusions or sharp edges that could puncture flashings.
  - 3. Seal lapped ends and penetrations of flashing before covering with mortar.
- C. Drip flashing shall be laid in a slurry of fresh mortar and mortar shall be placed on top of the flashing as well to maintain wall flexural strength.
- D. Lap end joints of flashings at least 4 inches and seal watertight.

### 3.11 LINTELS

- A. Loose steel angle lintels shall be provided for all openings in brick veneer and 4" CMU masonry as indicated in the lintel schedule or on the Structural Drawings. For miscellaneous loose steel lintels not specified on the Structural Drawings, refer to Section 05 50 00 - Metal Fabrications.
  - 1. All lintels at exterior openings shall be hot-dipped galvanized.
- B. Vertical cores below lintel ends shall be grouted solid full height to provide suitable bearing. Provide reinforcement at grouted cores as indicated on the Drawings.
- C. Temporarily brace lintels as required until mortar has adequately cured.
- D. Maintain minimum 8 inch bearing on each side of opening, unless otherwise indicated.

### 3.12 BUILT-IN WORK

- A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
  - 1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

### 3.13 CUTTING AND FITTING

- A. Cut and fit for chases, pipes, sleeves, and ductwork. Coordinate with other Sections of work to provide correct size, shape, and location.

- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

**3.14 CLEANING**

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. All exposed brick masonry shall be thoroughly cleaned. Before applying any cleaning agent to the entire wall, it shall be applied to a sample wall area of approximately 20 sq. ft. in a location approved by the Architect. No further cleaning work may proceed until the sample area has been approved by the Architect, after which time the same cleaning materials and method shall be used on the remaining wall area. Adequate water shall be available to thoroughly pre-soak and rinse all surfaces to be cleaned.
- E. All traces of excess mortar/grout, all efflorescence and all other construction stains shall be completely removed from exposed masonry.

**3.02 PROTECTION**

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.
- B. Protect finishes until completion of project.

**END OF SECTION**

**SECTION 05 50 00  
METAL FABRICATIONS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Steel pipe and tube railings.
- B. Shop fabricated miscellaneous steel and aluminum items. including but not limited to:
  - 1. Frames, brackets and supports for:
    - a. Supports for hardware, electrical equipment, and other items as indicated or required.
- C. It shall be a requirement of the Work of the Section to thoroughly review all of the Construction Documents and provide any and all miscellaneous metal fabrications required for a complete and proper job.

**1.02 RELATED REQUIREMENTS**

- A. Section 04 20 00 - Unit Masonry: Placement of metal fabrications in masonry.
- B. Section 05 12 00 - Structural Steel.
- C. Section 09 90 00 - Painting and Coating: Compatibility of paint finish systems with primers included in this Section, where applicable.

**1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit for manufactured products specified herein.
- C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include plans, elevations, and details where applicable.
- D. Certifications:
  - 1. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.
  - 2. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.
- E. Samples: Submit samples representative of materials and finished products as may be requested by the Architect.

**1.04 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.
- C. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code--Steel."
  - 2. AWS D1.3, "Structural Welding Code--Sheet Steel."

**1.05 PROJECT CONDITIONS**

- A. Field Measurements: Verify actual locations of railings and other metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS - STEEL**

- A. Steel Sections: ASTM A36.
- B. Steel Tubing: ASTM A500, Grade B cold-formed structural tubing.
- C. Plates: ASTM A283.
- D. Pipe: ASTM A 53, Type F or Type S, Grade A Standard Weight, unless another grade and weight are required by structural loads.

- 1. Provide galvanized finish for exterior installations and where indicated.

- E. Fasteners: ASTM B33, Class FE/Zn 25 for electro-plated zinc coating, for exterior. Select fasteners for the type, grade, and class required.
- F. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
- H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

### **2.02 FABRICATION**

- A. NOTE: It is the Owner's intent to use energy conserving, environmentally friendly materials to the greatest extent practical. The Contractor is therefore encouraged to use recycled steel products.
- B. Metal fabrications shall be standard approved products, fabricated in accordance with best shop practices and, wherever possible, shop assembled, ready for erection.
- C. Metals shall be free from defects impairing strength, durability, or appearance and shall be best commercial quality for purposes specified. Metals shall be made with structural properties, to safely sustain and withstand strains, stresses, to which they will be normally subjected.
- D. Fit and shop assemble items in largest practical sections, for delivery to site.
- E. Fabricate items with joints tightly fitted and secured.
- F. Continuously seal joined members by continuous welds.
- G. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- H. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

- I. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- J. Fabricate railing to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- K. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
  - 1. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 weld; no evidence of a welded joint.
- L. Form changes in direction by bending. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking or otherwise deforming exposed surfaces of components.
- M. Close exposed ends of hollow railing members with prefabricated end fittings.

### **2.03 FABRICATED ITEMS**

- A. Miscellaneous Framing and Supports: Provide steel framing and supports for applications indicated that are not a part of structural steel scope as required to complete the Work. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent construction. Fabricate from steel shapes, plates, and steel bars of welded construction using mitered joints for field connections. Cut, drill, and tap units to receive hardware, hangers, and similar items. Equip units with integrally welded anchors for casting into concrete or building into masonry.

### **2.04 FINISHES - STEEL**

- A. Galvanizing:
  - 1. Applications: All exterior steel unless indicated for additional finish.
  - 2. Galvanize steel members after fabrication to ASTM A123 requirements by a member of the American Galvanizers Association, Inc with a high grade, non-lead zinc bath.
  - 3. Smoothness: galvanizing shall have a rugosity of 4 or less (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments.
  - 4. Warranty: Galvanizer's standard warranty that materials shall be free from 10% or more visible rust for 20 years.
  - 5. Where hot-dip galvanizing prior to completion of fabrication (cutting or welding operations) cannot be avoided, joints and cuts shall be finished with four (4) full coats of touch-up galvanizing repair paint as recommended by the fabricator.
  - 6. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated, comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1:

Shop, Field, and Maintenance Painting of Steel” for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

- E. High Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer’s written instructions and with requirements in SSPC-Pa 1, “Paint Application Specification No. 1: Shop, Field and Maintenance Painting of Steel,” for shop painting. Apply at spreading rates recommended by coating manufacturer.

- 1. Color: As selected by Architect from manufacturer’s full range.

## **2.7 FABRICATION TOLERANCES**

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive work. Coordinate all work with the work of other trades.

### **3.02 PREPARATION**

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.
- C. Shearing and punching shall leave clean true lines and surfaces. Weld or rivet permanent connections. Welds and flush rivets shall be finished flush and smooth on surfaces that will be exposed after installation. Welds shall be continuous unless otherwise noted. Welds shall not have voids or pockets and shall be ground to provide smooth transitions between metal surfaces. Do not use screws or bolts where they can be avoided; where used, heads shall be countersunk, screwed up tight and threads nicked to prevent loosening.
- D. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall give ample strength and stiffness. Joints exposed to weather shall be formed to exclude water. Provide holes and connections for the work of other trades.
- E. Connections and accessories shall be adequate to safely sustain, withstand stresses, strains, to which they will be normally subjected.
  - 1. Bolts, nuts, screws for exterior work shall be electrogalvanized, unless otherwise noted.
- F. Furnish all standard screws, bolts, washers, and other such fastening devices as are necessary for attaching this work to other materials. Anchors and other connecting devices required in concrete or masonry shall be built-in as the work progresses. NOTE: Special attention shall be given to the firm and secure anchoring of overhead mounted materials and equipment.
- G. Do cutting, punching, drilling, tapping required for attachment of other work coming in contact with miscellaneous metal where so indicated or where directions for same are given prior to or with review of shop drawings.
- H. Unless otherwise indicated, bolt, and screw heads shall be flat countersunk in exposed faces of ornamental or finished character; elsewhere as required. Cut off bolts, screws, etc., where exposed, flush with nuts, or other adjacent metal. Except as otherwise required, weld shop-

assembled connections; welds, bolts, or machine screws may be used for field connections. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous. Exposed fastenings shall be the same materials, color, and finish as metal to which they apply, unless otherwise required.

- I. Make up threaded connections tightly so that threads will be entirely concealed by fittings.
- J. Allow for thermal movement resulting from a maximum temperature range change of 120 degrees F ambient and 180 degrees F surface by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and night time sky heat loss.

### **3.03 INSTALLATION**

- A. Install items plumb and level, accurately fitted, free from distortion or defects. All work shall be designed for adjustment to field variation, fitted with proper joints and intersections, adequately anchored in place.
- B. Perform field welding in accordance with AWS D1.1.
- C. Obtain approval prior to site cutting or making adjustments not scheduled.
- D. Perform cutting, drilling, and fitting required for installing railing. Set railing accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
  - 1. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2mm in 1m).
  - 2. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed ¼ inch in 12 feet (5mm in 3 m).
- E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other material from direction contact with incompatible materials.
- F. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with non-shrink, nonmetallic grout.
- G. Touchup painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material use for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- H. Install all supporting members, fastening, framing, hangers, bracing, brackets, straps, bolts, angles, and the like required to set, connect work rigidly and properly to structural steel, masonry, other construction.
- I. Immediately after erection, clean field welds, bolted connections and abraded areas of shop paint, and paint exposed areas with the same materials as used for shop painting, complying with SSPC-PA1. Apply by brush or spray to provide a minimum 2 mil dry film thickness. Clean field welds, bolted connections and abraded areas of galvanized surfaces to comply with ASTM A780.

**END OF SECTION**

**SECTION 06 10 00  
ROUGH CARPENTRY**

**PART 1 GENERAL**

**1.01 WORK INCLUDES**

- A. Provide all rough carpentry work, as indicated on the Drawings and as specified herein. Rough Carpentry shall include but not be limited to:
  - 1. Concealed blocking.
  - 2. Roofing nailers.
  - 3. Roofing cant strips.
  - 4. Pressure treated wood materials.

**1.02 RELATED WORK**

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
  - 1. Section 07 53 10 FULLY ADHERED EPDM
  - 2. Section 07 62 00 SHEET METAL FLASHING AND FASCIA
  - 3. Section 07 72 00 ROOF ACCESSORIES

**1.03 QUALITY ASSURANCE**

- A. Materials and workmanship shall conform to governing laws and applicable building code.
- B. Provide lumber and plywood bearing the grade-trademark of the association under the rules or standards of which it was produced. Grade-trademarks shall conform to the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
  - 1. ASTM D 245 - Lumber grades shall be determined in accordance. Grades specified are the minimum acceptable.
  - 2. USDC PS 20 - Lumber shall bear the grade mark of an American Lumber Standards Committee, Board of Review-approved agency.
  - 3. Lumber shall bear a mark of mill identification.
  - 4. USDC PS 1 and ANSI A199.1 - Plywood shall comply with APA Design/Construction Guide, Residential and Commercial, grading requirements.
  - 5. APA PRP-108 - Non-plywood type performance-rated construction panels shall conform.
  - 6. CABO NER-272 - Fasteners shall comply.
  - 7. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010b.
  - 8. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood Protection Association; 2010.
  - 9. SPIB (GR) - Grading Rules; Southern Pine Inspection Bureau, Inc.; 2002.

**1.04 SUBMITTALS**

- A. Shop Drawings: Submit shop drawings of wood blocking installation and other rough carpentry work in conformance with Factory Mutual wind uplift rated systems. Describe proposed methods of installation and anchorage to structure showing sizes, types, thicknesses, connections of wood blocking and related items including adjoining work by other trades.
- B. Samples: Submit representative samples of all materials for use under this Section.



- C. Product Data: Submit manufacturer's printed product data for each material used. Provide certifications that materials and systems comply with specified requirements.
- D. Certificates: Submit certificates of grading, treatment and conformance to specified standards. Certifications shall state date of treatment, conformance with specifications and agency grading of wood.

#### **1.05 COORDINATION**

- A. Coordinate the work of this Section with the work of other Sections to assure the steady progress of all the work of the Contract.
- B. Field Measurements: Take field measurements before preparation of shop drawings and fabrication. Do not delay progress of the job. If field measurements are not possible prior to fabrication, allow for field cutting and fitting.

#### **1.06 PRODUCT DELIVERY AND STORAGE**

- A. Materials when delivered to site shall be stacked and stored above the ground under protective coverings or indoors in such manner as to insure proper drainage, ventilation, and protection.
- B. Rough carpentry materials shall be stored on elevated piles to allow for air circulation below and tipped in one direction to effectively drain moisture. Lumber shall be wrapped completely, including bottoms, in waterproof tarps. Tarps shall be tied down to protect against wind blow-off. Should delays in Project be anticipated, lumber shall be stored in covered storage trailers.
- C. Do not leave any newly installed wood blocking exposed. Cover and protect all new wood daily with the new roof systems or other suitable covering approved by the Architect.

### **PART 2 PRODUCTS**

#### **2.01 LUMBER**

- A. Provide lumber for miscellaneous wood framing, blocking, cant strips, nailers, etc. for all work of the Project, including, but not limiting to, temporary railings, roofing, flashing, sheet metal work, and the like.
- 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. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
  - 3. Lumber shall be surfaced four sides (S4S) and shall bear the grade and trademark of the association under whose rules it is produced, and a mark of mill identification.
- C. Provide new lumber of consistent size, free of stains and mildew, kiln dried to a maximum moisture content of not more than 19% by weight.
- D. Where exposed or semi-exposed, provide wood members selected for best possible appearance from the grade of stock specified.
- E. Lumber shall be furnished in longest practical lengths with respect to each intended use, and single length pieces shall be used wherever possible.
- F. General Carpentry Material Schedule shall be as follows:

<u>Item</u>	<u>Grade</u>	<u>Species</u>
Lumber 2 in. nominal thickness or greater	Construction Grade	Spruce – Pine - Fir
Lumber less than 2 in. nominal thickness	Construction Grade	Spruce – Pine - Fir

## 2.02 PRESSURE TREATED LUMBER

- A. Pressure treat lumber above ground and in contact with roofing, flashing, sheet metal, masonry, concrete, dampproofing, and waterproofing in conformance with AWP A U1. Provide pressure preservative treated lumber with a minimum net retention of 0.25 pcf. Dry lumber to maximum moisture content of 19% after treatment. Use only waterborne preservatives which conform to AWP A P5. Creosote preservatives are not acceptable.
  1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWP A standards.

## 2.03 MISCELLANEOUS MATERIALS

- A. Inserts, Anchors, and Fasteners: Provide inserts, anchors, anchor bolts, lag bolts, screws, washers, nuts, nails, and other rough hardware. Assist other trades as necessary in the placement of inserts and anchor bolts in concrete and masonry. Furnish full instructions regarding locations, sizes, and other requirements to ensure proper preparation. Provide rough hardware which complies with requirements of the governing laws and codes.
  1. Metal and Finish: Stainless steel for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
- B. Rough Hardware: Provide rough hardware items for use at roof and other exterior uses hot-dip galvanized in accordance with ASTM A 153. Provide other concealed items cadmium plated or zinc chromate plated.
- C. Provide hammer drive anchors and fasteners for securing wood framing, blocking or plywood into masonry of sufficient length to penetrate the receiving member a minimum of 1-1/2 in.
- D. Adhesives for Gluing Wood Members to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

## PART 3 EXECUTION

### 3.01 ROUGH CARPENTRY WORK – GENERAL

- A. No attempt is made in this Specification to list the various elements of rough carpentry work, as the major part of the work to be done is clearly shown on or reasonably inferred from the Drawings. The rough carpentry work required shall include all such work, regardless of whether or not each and every item is specifically called for. Refer to Drawings to determine the major extent of the rough carpentry work required.
- B. The Contractor shall be responsible for structural integrity, connections, and anchorage of rough carpentry work. All nailing shall be in accordance with the applicable building code.
- C. Discard units of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned, or too small to fabricate with minimum number of joint or optimum jointing arrangements, or which are of defective quality with respect to surfaces or sizes.
- D. Unless indicated otherwise, blockings, nailers, etc., of 2 in. nominal thickness or greater shall be bolted to back-up material with 1/2 in. bolts (galvanized at exterior locations and at roofs) located

- 4 in. from ends and splices, and spaced not greater than 32 in. on center along lengths of the members. Provide nails of sufficient length to penetrate receiving member a minimum of 1-1/2 in.
- E. Unless indicated otherwise, secure 2 in. thick or smaller wood framing, nailers, furring, etc., to back-up material by use of appropriate fasteners located 4 in. from ends and spaced not greater than 16 in. on center along lengths of the members. Provide type and length of fastening devices to develop positive and secure anchorage to the back-up material.
  - F. Refer to FM Data Sheet 1-49 concerning anchorage spacing and size requirements for perimeter blocking. Spacings shall be halved in the zone from building corner to eight feet from corner, both directions from corner.
  - G. Butt joints in wood shall be flush to provide a smooth, uniform line with no irregularities. Built-up blocking shall have butt joints staggered 4 in. minimum layer to layer. The minimum length of any individual piece of woodwork shall be 12 in. All lengths of woodwork shall have a minimum of four fasteners.
  - H. Construct all rough carpentry work plumb, level, and true with tight, close fitting joints, securely attached and braced to surrounding construction, all in a first class workmanlike manner. Counterbore for bolt heads, nuts, and washers where required to avoid interference with other materials.
  - I. Wood blockings, nailers, edgings, etc., shall be installed as indicated or specified and shall be furnished in lengths not less than 12 ft., except where shorter lengths are required. Select material sizes to minimize waste.
  - J. All connections, nailing, and fastening of rough carpentry work shall conform to requirements of the governing laws and codes.
  - K. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
  - L. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.
  - M. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces.
  - N. Repair all damage caused by puncturing of conduits, pipes, ducts, etc. when nailing, drilling or powder driving into concrete or masonry.

### **3.02 FASTENING OF WOODWORK**

- A. Wood to masonry connections shall be completed using non-impact drilled anchors through predrilled holes spaced 8 in. on center maximum. Predrill the hole, insert fastener sleeve, and secure in place with nail.
- B. Install plywood on masonry surfaces hammer driven anchors through predrilled holes spaced 12 in. on center along the top and bottom edges. Keep fasteners 3 in. minimum from the board edge. Drive fastener heads flush with surface. Secure plywood to wood substrate with nails at same spacing as hammer driven anchors. Secure plywood to metal studs with screws approved by metal stud manufacturer.
- C. Wood shall be secured to wood substrates and other wood to wood connection with nails spaced 12 in. on center maximum staggered along the centerline of the member being installed. All nail heads must be flush with the top surface.

### **3.03 CLEANING**

- A. Upon completion of rough carpentry work in any given area, remove all rubbish and debris from the work area and leave in broom clean condition.

**END OF SECTION**

**SECTION 06 18 00  
GLUED-LAMINATED CONSTRUCTION**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of this section.
- B. Examine all other sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

**1.02 DESCRIPTION OF WORK**

- A. Section includes framing using structural glued-laminated timber.

**1.03 DEFINITIONS**

- A. Structural Glued-Laminated (Glulam) Timber: An engineered, stress-rated timber product assembled from selected and prepared wood laminations bonded together with adhesives and with the grain of the laminations approximately parallel longitudinally.

**1.04 SUBMITTALS**

- A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with Division 1.
- B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.
- C. All submittals shall be reviewed and returned to the Architect within 10 working days.
- D. Incomplete submittals will not be reviewed.
- E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in sections Division 1 have been complied with.
- F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.
- G. Electronic Submittals:
  - 1. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained, and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.
  - 2. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Adobe Acrobat Professional version 7.0 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.
  - 3. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with. Electronic submittals without the Contractor's approval will be rejected and returned.

4. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.
- H. Product Data: For each type of product.
  1. Include data on lumber, adhesives, fabrication, and protection.
  2. For connectors, Include installation instructions.
- I. Shop Drawings:
  1. Show layout of structural glued-laminated timber system and full dimensions of each member.
  2. Indicate species and laminating combination.
  3. Include large-scale (1"-1ft min) details of all connections.
- J. Samples: Full width and depth, 24 inches long, showing the range of variation to be expected in appearance of structural glued-laminated timber.
  1. Apply specified factory finish to three sides of half length of each Sample.
- K. Certificates of Conformance: Issued by a qualified testing and inspecting agency indicating that structural glued-laminated timber complies with requirements in AITC A190.1.
- L. Research/Evaluation Reports: For structural glued-laminated timber and timber connectors, from ICC-ES.

## **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: An AITC- or APA-EWS-licensed firm certified for chain of custody by an FSC-accredited certification body.

## **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. General: Comply with provisions in AITC 111.
- B. Individually wrap members using plastic-coated paper covering with water-resistant seams.

# **PART 2 PRODUCTS**

## **2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Unalam

## **1. STRUCTURAL GLUED-LAMINATED TIMBER**

- A. General: Provide structural glued-laminated timber that complies with AITC A190.1 and AITC 117 or research/evaluation reports acceptable to authorities having jurisdiction.
  1. Factory mark each piece of structural glued-laminated timber with AITC Quality Mark or APA-EWS trademark. Place mark on surfaces that are not exposed in the completed Work.
  2. Provide structural glued-laminated timber made from single species.
  3. Provide structural glued-laminated timber made from solid lumber laminations; do not use laminated veneer lumber.
  4. Provide structural glued-laminated timber made with wet-use adhesive complying with AITC A190.1.
  5. Adhesive shall not contain urea-formaldehyde resins.
- B. Species and Grades for Beams and Purlins:
  1. Species and Beam Stress Classification: Southern-Pine, 24F-V3, 1.8E or better U.N.O.
  2. Lay-up: Unbalanced

- C. Species and Grades for Columns:
  - 1. Species and Combination Symbol: Southern-Pine, 24F- 1.8E or better U.N.O.
  - 2. Lay-up: Balanced
- D. Appearance Grade: Architectural, complying with AITC 110.
  - 1. For Architectural appearance grades, fill voids as required by AITC 110. Use clear wood inserts, of matching grain and color, for filling voids and knot holes more than 1/4 inch wide.

## **2.02 PRESERVATIVE TREATMENT**

- A. Preservative Treatment: all glulam to receive preservative-treatment. Comply with AWWA U1 Category 3B
  - 1. Use preservative solution without water repellent or substance that might interfere with application of indicated finishes
  - 2. Do not incise structural glued-laminated timber or wood used to produce structural glued laminated timber.
- B. Preservative
  - 1. Oxine copper (copper-8-quinolinolate) in a light petroleum solvent

## **2.03 TIMBER CONNECTORS**

- A. Fabricate beam and column connections from steel with minimum 1/4" bearing plates and side plates, as shown on the drawings.
- B. Provide bolts, 3/4" unless otherwise indicated, complying with ASTM A 307, Grade A; nuts complying with ASTM A 563; and, where indicated, flat washers.
- C. Materials: Unless otherwise indicated, fabricate from the following materials:
  - 1. Structural-steel shapes, plates, and flat bars complying with ASTM A 36/A 36M.
  - 2. Hollow Structural Steel complying with ASTM A46 GR B
- D. Hot-dip galvanize steel assemblies and fasteners after fabrication to comply with ASTM A 123/A 123M or ASTM A 153/A 153M.
- E. Provide flat black powder coated finish for all connectors.

## **2.04 MISCELLANEOUS MATERIALS**

- A. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
- B. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

## **2.05 FABRICATION**

- A. Shop fabricate connections to greatest extent possible, including cutting to length and drilling bolt holes.
  - 1. Dress exposed surfaces as needed to remove planing and surfacing marks.
- B. Camber: Fabricate horizontal and inclined members of less than 1:1 slope with either circular or parabolic camber equal to 1/500 of span.
- C. Where preservative-treated members are indicated, fabricate (cut, drill, surface, and sand) before treatment to greatest extent possible. Where fabrication must be done after treatment, apply a field-treatment preservative to comply with AWWA M4.
  - 1. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.
- D. End-Cut Sealing: Immediately after end cutting each member to final length, apply a saturation coat of end sealer to ends and other cross-cut surfaces, keeping surfaces flood coated for not less than 10 minutes.
- E. Seal Coat: After fabricating, sanding, and end-coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit.

**2.06 FACTORY FINISHING**

- A. Wiped Stain Finish: Manufacturer's standard, dry-appearance, penetrating acrylic stain and sealer; oven dried and resistant to mildew and fungus.
  - 1. Color: As selected by Architect from manufacturer's full range

**PART 3 EXECUTION****3.01 EXAMINATION**

- A. Examine substrates in areas to receive structural glued-laminated timber, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.02 INSTALLATION**

- A. General: Erect structural glued-laminated timber true and plumb and with uniform, close-fitting joints. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
  - 1. Handle and temporarily support glued-laminated timber to prevent surface damage, compression, and other effects that might interfere with indicated finish.
- B. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.
- C. Fit structural glued-laminated timber by cutting and restoring exposed surfaces to match specified surfacing and finishing.
  - 1. Predrill for fasteners using timber connectors as templates.
  - 2. Finish exposed surfaces to remove planing or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
  - 3. Coat cross cuts with end sealer.
  - 4. Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWP A M4.
    - a. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.
- D. Install timber connectors as indicated.
  - 1. Unless otherwise indicated, install bolts with same orientation within each connection and in similar connections.
  - 2. Install bolts with orientation as indicated or, if not indicated, as directed by Architect.
  - 3. Temporary Shoring and Bracing:
    - a. This is the sole responsibility of the Contractor. Provide temporary shoring and bracing members with connections of sufficient strength to support imposed loads. Remove temporary members and connections when all permanent members are in place, and all final connections are made, including the floor and roof diaphragms. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds. Comply with OSHA Standard referenced previous. Retain the services of a Specialty Structural Engineer (Not the Engineer of Record) to design specialty shoring and bracing.

**3.03 ADJUSTING**

- A. Repair damaged surfaces and finishes after completing erection. Replace damaged structural glued-laminated timber if repairs are not approved by Architect.



### **3.04 PROTECTION**

- A. Do not remove wrappings on individually wrapped members until they no longer serve a useful purpose, including protection from weather, sunlight, soiling, and damage from work of other trades.
  - 1. Coordinate wrapping removal with finishing work. Retain wrapping where it can serve as a painting shield.
  - 2. Slit underside of wrapping to prevent accumulation of moisture inside the wrapping.

**END OF SECTION**

**SECTION 06 20 00  
FINISH CARPENTRY & ARCHITECTURAL MILLWORK**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Custom woodwork items including but not limited to:
  - 1. Wood cabinets and casework.
  - 2. Solid-surface material countertops
  - 3. Open shelving on brackets and standards
  - 4. Wood window sills and fixed bench/shelf
  - 5. Solid wood exterior trellis
- B. Hardware and attachment accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 10 00 – Rough Carpentry: Concealed wood blocking.

**1.03 REFERENCE STANDARDS**

- A. ANSI A208.1 - American National Standard for Particleboard; 2009.
- B. ANSI A208.2 - American National Standard for Medium Density Fiberboard; 2009.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. AWI/AWMAC/WI - Architectural Woodwork Standards; 2009.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with installation of associated and adjacent components.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's technical information for all fabricated products, and accessories specified herein.
- C. Shop Drawings: Indicate materials, elevations, construction, clearances, component profiles, fastening methods, jointing details, finishes, hardware locations and accessories.
  - 1. Minimum Scale of Detail Drawings: 1-1/2 inch to 1 foot.
  - 2. Provide the information required by AWI/AWMAC/WI (AWS).
- D. Samples:
  - 1. Submit confirmation samples and color chips for selected wood finish and solid surfacing.

**1.06 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this Section with minimum five years of documented experience, with at least one project in the past 5 years with value of woodwork within 50 percent of cost of woodwork for this Project.
- B. Installer Qualifications: An experience Installer who has completed architectural woodwork similar in material, design, and extend to that indicated for this Project and whose work has resulting in construction with a record of successful in-service performance.

**1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Protect woodwork and millwork during transit, delivery, storage and handling to prevent moisture and other damage, soiling and deterioration.

- B. Do not deliver millwork until environmental conditions are suitable (enclosed, dry, with operating HVAC system), and painting and similar operations that could damage woodwork and millwork are complete.

#### **1.08 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not deliver or install woodwork until wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: The woodwork fabricator shall be responsible for coordinating the dimensions of all his work with actual field conditions. The Contractor and fabricator shall cooperate to establish and maintain dimensions as required for a proper fit, without field modifications. Verify locations of concealed framing, blocking, reinforcements, and furring that support woodwork by accurate measurements before being enclosed.

#### **1.09 COORDINATION**

- A. Coordinate sizes and locations of framing, blocking, furring reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Species and Cut for Transparent Finish: Select white maple, plain sawn or sliced.
- C. Wood Products: Comply with the following:
  - 1. Hardboard: AHA A135.4.
  - 2. Medium-Density Fiberboard, MDF: ANSI A208.2, Grade MD-21, 48 lb. density.
  - 3. Particleboard: ANSI A208.1, Grade M-2.
  - 4. Hardwood Plywood and Face Veneers: HPVA HP-1, Grade A veneers.
    - a. Veneer Core Construction, All Locations Except as Noted: Veneer core plywood, no voids; poplar core veneers.
      - 1) 3/4-Inch Thickness: 7 plies.
      - 2) 1/2-Inch Thickness: 5 plies.

#### **2.02 INSTALLATION MATERIALS**

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Screws: Select material, type, size, and finish required for each use and substrate. Comply with ASME B 18.6.1 for applicable requirements.
  - 1. For metal framing supports, provide screw as recommended by metal-framing manufacturer.
- C. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.
- D. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.
- E. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

**2.03 FABRICATION, GENERAL**

- A. Interior Woodwork Grade: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade indicated and any additional requirements of this Section. When quality grade is not indicated, provide Custom quality grade.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
  - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch (1.5 mm).
  - 2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
- D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - 1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
- E. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

**2.04 WOOD CABINETS FOR TRANSPARENT FINISH**

- A. Quality Standard: Comply with AWI Section 10 - Casework and additional specified requirements for wood cabinets.
- B. Grade: Custom.
- C. AWI Type of Cabinet Construction: Reveal overlay on face frame.
- D. Reveal Dimension: 1/2 inch, unless indicated otherwise.
- E. Wood Species and Cut for Exposed Surfaces: Select white maple, plain sawn or sliced.
  - 1. Grain Matching: Run and match grain vertically for doors and fixed panels.
  - 2. Matching of Veneer Leaves: Book match.
  - 3. Vertical Matching of Veneer Leaves: End match.
  - 4. Veneer Matching within Panel Face: Running match.
  - 5. Drawer Faces: Solid wood, grain run horizontally.
  - 6. Open Shelving: 1-inch thick for all widths.
    - a. Edge Treatment: Solid wood matching face for species and cut; front and back.
- G. Semiexposed Surfaces: Provide surface materials indicated below:
  - 1. Surfaces Other Than Drawer Bodies: Match species and cut indicated for exposed surfaces.
  - 2. Drawer Sides and Backs: Solid-hardwood lumber, same species indicated for exposed surfaces.
  - 3. Drawer Bottoms: Hardwood plywood, same species indicated for exposed surfaces.
  - 4. Shelving: Hardwood plywood, 3/4-inch thick for shelves up to 36 inches wide, 1-inch thick for shelves over 36 inches wide.
- H. Cabinet Fabrication:
  - 1. Door and Drawer Fronts: Solid-wood, 3/4 inch thick.
  - 2. Face Frames: 3/4-inch thick solid wood to match exposed species; stiles shall be 1-1/2 inches wide and rails shall be 1-3/4 inches wide.
  - 3. Exposed Cabinet End Construction and Finish: Wood veneer plywood, minimum 3/4-inch thick; exterior veneer to match cabinet species, interior wood veneer to be any white grain species.

- a. Sides of cabinets exposed when removable sink base is removed shall have exposed cabinet end finish.
- 4. Cabinet Tops and Bottoms: Hardwood plywood, 1/2-inch- thick, fully supported by and secured in rabbets in end panels, front frame, and back rail.
- 5. Unit Back Panels: Hardwood plywood, minimum 3/8-inch- thick, fastened to rear edge of end panels and to top and bottom rails.
- 6. Drawer Bodies: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
  - a. Join subfronts, backs, and sides with glued dovetail joints.
  - b. Subfronts, Backs, and Sides: 3/4-inch- thick solid hardwood.
  - c. Bottoms: Minimum 3/16-inch-thick hardwood plywood; inserted into dado in front, back and sides; glued and stapled to sides. Reinforce drawer bottoms with 1/2- by 4-inch front to back hardwood intermediate stiffeners, glued and fastened in place. Provide one stiffener for drawers to 24 inch width, two to 36 inch width and four to 48 inch width.
- 7. Shelves: 3/4-inch-thick hardwood plywood with hardwood veneer banded front edge.
- 8. Joinery: Rabbet backs flush into end panels and secure with concealed mechanical fasteners. Connect tops and bottoms of wall cabinets and bottoms and stretchers of base cabinets to ends and dividers with mechanical fasteners. Rabbet tops, bottoms, and backs into end panels.
- 8. Cabinet locks: provide at pairs of base cabinet doors, typical.
  - a. Hafele Modular Removable Core Locking System, SYMO 3000 or approved equal.
- 9. Cabinet Sub-Base: Separate and continuous (no cabinet body sides to floor), water resistant exterior grade plywood with concealed fastening to cabinet bottom. Ladder type construction of front, back, and intermediates to form a secure and level platform to which cabinets attach.

## **2.05 WOOD BENCH, SHELVING AND WINDOW SILLS FOR TRANSPARENT FINISH**

- A. Quality Standard: Comply with AWI Section 10 - Casework and additional specified requirements for wood cabinets.
- B. Grade: Custom.
- C. Wood Species and Cut for Exposed Surfaces: Select white maple, plain sawn or sliced.
  - 1. 3/4-inch-thick hardwood plywood with hardwood veneer banded front edge.
    - a. Edge Treatment: Solid wood matching face for species and cut; front and back.
    - b. Grain Matching: Run and match grain across width of window/wall, typical.
  - 2. Matching of Veneer Leaves: Book match.
  - 3. Vertical Matching of Veneer Leaves: End match.
  - 4. Veneer Matching within Panel Face: Running match.
- D. Bench/Shelf Support: Inside Wall Bench Support
  - 1. Product: Rakks EHB Inside Wall Bench Bracket
    - a, Size: 15.7" x 14.25"
    - b, Finish: Unfinished Milled

## **2.06 CLOSET SHELVING**

- A. Adjustable closet shelving for opaque finish: Fabricate to detail; plywood, 3/4-inch thick, with solid hardwood edge band.
- B. Metal standards: Knap & Vogt Heavy Duty Standards or approved equal.
- C. Brackets: Knap & Vogt Heavy-Duty Adjustable Shelf Brackets or approved equal.

## **2.07 SOLID-SURFACE-MATERIAL COUNTERTOPS**

- A. Configuration: Provide countertops with the following front and backsplash style:
  - 1. Front: Straight, 1/4-inch radius at top 1-inch laminated bullnose.
  - 2. Backsplash: Provide integral cove where backsplash meets the top, chemically bonded. Flat, slightly eased at exposed edge for top of backsplash.

- B. Countertops: 1/2-inch- thick, solid surface material with front edge built up with same material.
- C. Backsplashes and Endsplashes: 1/2-inch- thick, solid surface material.
- D. Fabrication: Fabricate tops in one piece with integral chemically bonded shop-applied edges and backsplashes. Provide continuous 3/8-inch deep scribe strip along top back edge and ends of back splash. Provide built-up nosing with concealed drip groove. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
- E. Drill holes and make cutouts in countertops for plumbing fittings in shop.

## **2.08 SOLID WOOD EXTERIOR TRELLIS**

- A. 2 X8 Members: Solid Douglas Fir
  - 1. Grade: Select Structural No. 1.
  - 2. Finish: Dry appearance, penetrating acrylic stain and sealer as specified.

## **2.09 SHOP FINISHING**

- A. Quality Standard: Comply with AWI Section 5 - Finishing, unless otherwise indicated.
  - 1. Grade: Provide finishes of same grades as items to be finished.
- B. General: Shop finish transparent finished interior architectural woodwork at fabrication shop as specified in this Section.
- C. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
  - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative overlay.
- D. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523:
  - 1. Grade: Custom.
  - 2. AWI Finish System: Catalyzed polyurethane.
  - 3. Staining: Match Architect's sample.
  - 4. Sheen: Satin, 30-50 gloss units.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

### **3.02 INSTALLATION**

- A. Quality Standard: Install cabinets to comply with same grade as item to be installed.
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.

- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- E. Cabinets and Casework: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
  - 2. Maintain veneer sequence matching of cabinets with transparent finish.
  - 3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c.
- F. Cabinet Mounted Countertops: Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
  - 1. Scribe back splashes to conform to wall. Set back edge in bed of sealant to prevent water from running behind splash.
  - 2. Install countertops level to a tolerance of 1/8 inch in 8 feet.

### **3.03 ADJUSTING AND CLEANING**

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

### **3.04 PROTECTION**

- A. Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that woodwork is without damage or deterioration at time of Substantial Completion.

**END OF SECTION**

**SECTION 07 53 10**  
**EPDM SINGLE-PLY MEMBRANE ROOFING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fully adhered EPDM single ply membrane roofing at the new entrance.

**1.02 RELATED SECTIONS**

- A. Division 06 Section "Rough Carpentry" for wood blocking.
- B. Division 07 Section "Thermal Insulation" for roof insulation.
- C. Division 07 Section "Sheet Metal Flashing and Trim" for flashings and trim.

**1.03 DEFINITIONS**

- A. General: Install sheet membrane roofing and base flashing that are watertight; will not permit the passage liquid water; and will withstand wind loads, thermally induced movement, and exposure to weather without failure.

**1.04 PERFORMANCE REQUIREMENTS**

- A. General: Install sheet membrane roofing and base flashing that are watertight; will not permit the passage of liquid water; and will withstand wind loads, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

**1.05 SUBMITTALS**

- A. Product Data including manufacturer's material and finish data, installation, instructions, and general recommendations for each specified flashing material and fabricated product.
- B. Shop Drawings: Include plans, sections, and details of the following:
  - 1. Base flashings and membrane terminations.
  - 2. Tapered insulation, including slopes and drain sumps.
- B. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install specified roofing system.
- C. Manufacturer Certificates: Signed by roofing manufacturer certifying that the roofing system complies with requirements specified. Upon request, submit evidence of meeting requirements.
- D. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of components of roofing system with requirements based on comprehensive testing of current product compositions.
- E. Research/Evaluation Reports: Evidence of roofing system's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
- F. Warranty: Sample copy of standard roofing system manufacturer's warranty stating obligations, remedies, limitations, and exclusions of warranty.
- G. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.



## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing roofing similar to that required for this Project and who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product.
- B. Provide an unrestricted, licensed construction supervisor on site during all operations.
- C. Pre-installation Conference: Before installing roofing system, conduct conference at Project site to comply with requirements of 01015 Section "Project Meetings." Notify participants at least 5 working days before conference.
  - 1. Meet with Owner; Owner's representative; Owner's insurer, if applicable; testing and inspecting agency representative; roofing Installer; roofing system manufacturer's representative; deck Installer; and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
  - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
  - 3. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
  - 4. Review loading limitations of deck during and after roofing.
  - 5. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing.
  - 6. Review temporary protection requirements for roofing system during and after installation.
  - 7. Review roof observation and repair procedures after roofing installation.
  - 8. Document proceedings, including corrective measures or actions required, and furnish copy of record to each participant.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
  - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

## 1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with roofing work only when existing and forecasted weather conditions permit roofing to be installed according to manufacturers' written instructions and warranty requirements.

## 1.9 WARRANTY

- A. General Warranty: The warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Standard Roofing Manufacturer's Warranty: Submit a written warranty, without monetary limitation, signed by roofing system manufacturer agreeing to promptly repair leaks resulting from defects in materials or workmanship for the following warranty period
  - 1. Warranty Period: 20 year Gold Seal from Carlisle.
  - 2. Warranty Period: 20 year Red Shield System Warranty from Firestone
  - 3. Warranty Period: 20 year Peak Advantage System Warranty from Johns Manville.
- C. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including membrane roofing, sheet flashing, roof insulation, fasteners, and vapor retarders, if any, for the following warranty period:
  - 1. Warranty Period: 2 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: All roofing materials shall be Carlisle, Firestone or Johns Manville.
  - 1. EPDM Sheet:
    - a. Carlisle Syntec Systems; Carlisle Corp.; Sure-Seal (Black) EPDM .060
    - b. Firestone; Firestone Building Products; Rubbergard (Black) EPDM .060
    - c. Johns Manville; SE6A (Black) EPDM .060
  - 2. Polyisocyanurate Board Insulation:
    - a. Carlisle Syntec Systems, Carlisle Corp.
    - b. Firestone; Firestone Building Products
    - c. Johns Manville; Johns Manville Roofing Systems

### 2.2 EPDM SHEET

- A. EPDM Sheet: Uniform, flexible sheet formed from a terpolymer of ethylene-propylene-diene, complying with ASTM D 4637, Type 1, of the following grade, class, thickness, backing, and exposed face color:
  - 1. Grade and Class: Grade 1 and Class U, un-reinforced.
  - 2. Thickness: 60 mils, nominal.
  - 3. Backing: Un-backed.
  - 4. Exposed Face Color: Black.

### 2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by roofing system manufacturer for intended use and compatible with EPDM membrane roofing.
  - 1. Furnish liquid-type auxiliary materials that meet VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: 60-mil thick EPDM, uncured or cured, according to application.

- C. Bonding Adhesive: Manufacturer's standard bonding adhesive.
- D. Splice Adhesive and Cleaner: Single-component butyl splicing adhesive and solvent-based splice cleaner.
- E. Splice Primer and Tape: Manufacturer's standard synthetic rubber polymer primer and 6-inch wide minimum, butyl splice tape with release film.
- F. Lap Sealant: Manufacturer's standard single-component sealant.
- G. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- H. Metal Termination Bars: Manufacturer's standard aluminum bars, approximately 1 inch wide, roll formed and pre-punched.
- I. Metal Batts: Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, pre-punched.
- J. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions of FM 4470, designed for fastening sheet to substrate, and acceptable to roofing system manufacturer.
- K. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, in-seam sealants, termination reglets, and other accessories recommended by roofing system manufacturer for intended use.

## 2.4 INSULATION MATERIALS

- A. General: Provide preformed roof insulation boards that comply with requirements, selected from manufacturer's standard sizes and of thicknesses indicated.
  - 1. Provide preformed, tapered insulation boards where indicated. Fabricate with the following taper:
    - a. 1/8" per foot, 1" minimum thickness.
  - 2. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.
- B. Polyisocyanurate Board Insulation: Rigid, cellular polyisocyanurate thermal insulation with core formed by using HCFC's as blowing agents to comply with ASTM C 1289, classified by facer type as follows:
  - 1. Facer Type: Type II, felt or glass-fiber mat on both major surfaces.
  - 2. 25 PSI
  - 3. 1/8" taper, 1" minimum.
- C. High Density Polyisocyanurate Cover Board
  - 1. 4'x 8' rigid roof insulation composed of a high density closed cell polyisocyanurate foam core laminated to a premium performance coated glass fiber-mat facer.
    - a. 1/2" SecurShield HD™ by Carlisle Syntech
    - b. 1/2" IsoGard HD™ by Firestone Building Products
    - c. 1/4" InvinsaBoard™ by Johns Manville Roofing Supply

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions under which roofing will be applied, with installer present, for compliance with requirements.
  - B. Verify that roof openings and penetrations are in place and set and braced.
  - C. Verify that wood nailers are in place and secured and match thicknesses of insulation required.
- 3.2 Do not proceed with installation until unsatisfactory conditions have been corrected.
- 3.3 PREPARATION
- A. Clean substrate of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
  - B. Remove all roofing and vapor barriers completely to expose clean roof deck.
  - C. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
  - D. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of the roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- 3.4 INSULATION INSTALLATION
- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
  - B. Comply with roofing system manufacturer's written instructions for installing roof insulation.
  - C. Install tapered insulation under area of roofing to conform to slopes indicated and to Shop Drawings.
  - D. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
  - E. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
    - 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
  - F. Attached Insulation: Install each layer of insulation and secure to deck using adhesive specifically designed for fastening specified board-type roof insulation to deck type indicated.
- 3.5 ADHERED SHEET INSTALLATION
- A. Install EPDM sheet over area to receive roofing according to roofing system manufacturer's written instructions. Unroll sheet and allow to relax for a minimum of 30

minutes.

- B. Start installation of sheet in presence of roofing system manufacturer's technical personnel.
- C. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Apply bonding adhesive to substrate and underside of sheet at rate required by manufacturer and allow to partially dry. Do not apply bonding adhesive to splice area of sheet.
- E. **Install EPDM membrane in a layout that minimizes field seams. The intent of the project is to install a new fully adhered roof membrane with a minimum of field seams and patches. While manufacturers allow extensive filed patches it is the Universities policy to minimize un-necessary field seams. Roofing deemed to have an unacceptable level of patches or seams will not be accepted.**
- F. **Field sheet and flashing membrane wrinkles shall be minimized. Field sheet and base flashings shall be fully adhered without significant wrinkles. Field sheet or flashings deemed by the University or its Owner's Representative to be excessive will not be accepted.**
- G. **Remove only as much roofing that can be completely replaced on the same day.**
- H. **Phased construction not allowed. Complete flashings 100% daily.**

### 3.6 SEAM INSTALLATION

- A. Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping sheets according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet terminations.
- B. Repair tears, voids, and lapped seams in roofing that does not meet requirements.
- C. Utilize 6" seam tape.

### 3.7 FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to roofing system manufacturer's written instructions. All flashing shall be fully adhered. Loose or un-adhered flashing will not be acceptable.
- B. Apply bonding adhesive to substrate and underside of flashing sheet at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing as recommended by manufacturer.
- D. Clean splice areas, apply specified primers or cements, and firmly roll side and end laps of overlapping sheets according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars or other specified means of termination.

3.8 NIGHTLY TIE IN

- A. Contractor shall provide a sealed nightly tie-in with EPDM products every night regardless of weather forecast.
- B. All flashing shall be completed on a daily basis. Temporary flashing not allowed.

3.9 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Owner's representative.
  - 1. Notify Owner's representative or Owner 48 hours in advance of the date and time of inspection.

3.10 PROTECTING AND CLEANING

- A. Protect sheet membrane roofing from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Owner's representative and Owner.
- B. Correct deficiencies in or remove roofing that does not comply with requirements, repair substrates, reinstall roofing, and repair sheet flashings to a condition free of damage and deterioration at the time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

**END OF SECTION**

**SECTION 07 21 00  
THERMAL INSULATION****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Rigid board insulation at new roof and underside of new floor slab.
- B. Acoustic batt insulation in interior partitions.
- C. Under-slab vapor retarder.
- D. Foam insulation sealant for joints and small gaps.
- E. Adhesives, stick clips, tape, spring clips, etc.

**1.02 RELATED SECTIONS**

- A. Division 03 Section "Cast-in-Place Concrete" for installation of underslab vapor barrier and insulation boards.
- B. Division 07 Section "Foamed-In-Place Insulation" for foam insulation other than boards.
- C. Division 07 Section "EPDM Single Ply Membrane Roofing".
- D. Division 09 Section "Gypsum Board Assemblies" for acoustic insulation in partitions.

**1.03 REFERENCE STANDARDS**

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.
- B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2014.
- C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials; 2010.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Samples: Upon request, submit samples of each type of material to be used.

**1.05 FIELD CONDITIONS**

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

**1.06 PROTECTION, HANDLING AND STORAGE**

- A. Protect plastic insulation from exposure to sunlight, except as necessary for period of installation and concealment. Protect plastic insulation against ignition at all times. Do not deliver plastic insulation materials before installation time. Complete installation and concealment of plastic materials as quickly as possible.

**PART 2 PRODUCTS****2.01 APPLICATIONS**

- A. Rigid Under-slab Insulation Board: Extruded polystyrene board.
- B. Rigid Perimeter Insulation Board at Foundations: Extruded polystyrene board.
- C. Acoustic Glass Fiber Batt Insulation: For metal framed partitions as noted.

**2.02 FOAM BOARD INSULATION MATERIALS**

- A. Extruded Polystyrene Board Insulation: ASTM C578, Type IV; Extruded polystyrene board with either natural skin or cut cell surfaces.
  - 1. Surface Burning Characteristics, ASTM E84: Flame Spread Index: 5 or less, Smoke Developed Index 145 or less.

2. Board Size: 24 x 96 inch.
3. Board Thickness:
  - a. Under-slab: 2 inches, continuous 4 feet coverage from perimeter edge.
  - b. Perimeter Foundation Walls: 2 layers of 1 inch, staggered joints, full height.
  - c. Slab Edge: 1 inch, continuous.
  - d. Other Locations: Thickness for specific conditions as indicated on the Drawings.
4. Board Edges: Square.
5. Thermal Resistance at 75 degrees F: 5.0 per inch.
6. Compressive Resistance: 25 psi, unless otherwise specified.
  - a. Slab Edge: 60 psi.
7. All joints and gaps between insulation board shall be sealed with foam sealant compatible with the insulation board
8. Water Absorption, maximum: 0.1 percent, volume.
9. Products for Under-slab and Rigid Perimeter Insulation:
  - a. Styrofoam by Dow Chemical Co.
  - b. Foamular 250 by Owens Corning Corp.
10. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.03 BATT INSULATION MATERIALS**

- A. Glass Fiber Batt Insulation: (Acoustic) ASTM C665; flexible preformed batt or blanket, friction fit; minimum 25% recycled content.
  1. Surface Burning Characteristics, ASTM E84: Flame Spread Index 25 or less; Smoke Developed Index 450 or less.
  2. Formaldehyde Content: Zero.
  3. Thicknesses:
    - a. Partitions: 3 inches
    - b. Above ceilings: 6 inches (Music and kitchen).
  4. Facing: Unfaced within stud walls. Poly wrapped above ceilings.
  5. Products:
    - a. Sound Shield Free by Johns Manville.
    - b. EcoBatt by Knauf.
    - c. ComfortTherm by Johns Manville. (poly wrapped)
    - d. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.04 FOAM INSULATION SEALANT**

- A. Foam Insulation Sealant: Expanding, low VOC, HCFC-free, urethane foam sealant
  1. Products:
    - a. Pur Fil IG 750 Foam by Todol Products, Inc.
    - b. Great-stuff Pro by Dow Chemical Co.
    - c. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.05 ACCESSORIES**

- A. Fasteners and Adhesive: As recommended by the insulation manufactures and as approved by Factory Mutual, material manufacturers, and related codes where applicable. In general, adhesives and fasteners shall be "Construction Grade", corrosion resistant stainless steel or galvanized, as suitable for damp locations.
- B. Adhesive: Type recommended by insulation manufacturer for application.
- C. Tape: For furred wall insulation board; bright aluminum self-adhering type, reinforced, 2 inches wide.

### **2.06 UNDERSLAB VAPOR RETARDER**

- A. Underslab Vapor Retarder: Multi-ply, reinforced polyethylene, ASTM E1745, stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is prohibited.
  1. Water Vapor Permeance, ASTM E96: 0.03 perms max.



2. Puncture Resistance, ASTM D1709: 475 min
  3. Tensile Strength, ASTM D882: 45 lbf/in min.
  4. Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations air-tight in vapor retarder.
- B. Products:
- a. Griffolyn Type 65 by Reef Industries Co.
  - b. Moistop by Fortifiber Building Systems; 15mil minimum
  - c. Ply-Bar Plus II by Firstline Corp.
  - d. Stego Wrap Class C by Stego Industries; 15mil minimum
  - e. Husky Yellow Guard by Poly-America L.P.; 15mil minimum

### **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 UNDER CONCRETE SLABS**

- A. Exterior wall perimeters shall have horizontal rigid insulation installed for a width of four (4) feet, continuously placed below the underslab vapor retarder.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Prevent insulation from being displaced or damaged while placing vapor retarder and slab.

#### **3.03 UNDERSLAB VAPOR RETARDER INSTALLATION**

- A. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab. Vapor retarder shall be installed over entire area with seams lapped 12 inches and taped continuously. All penetrations shall be taped continuously. Edge of retarder shall be sealed against foundation wall.
  1. NOTE: Under slab vapor retarder installation shall be inspected prior to concrete pour and all penetrations, tears, disturbed areas, loose seams shall be repaired and re-inspected prior to commencement of concrete pour.

#### **3.04 FIBEROUS BATT AND BOARD INSTALLATION**

- A. Install fibrous board and batt insulation in accordance with manufacturer's instructions.
- B. Install thermal insulation at miscellaneous exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Install acoustic insulation between studs and other materials. Friction fit to prevent sliding and sagging. Provide additional clips and fasteners as required.
- D. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- E. Fit insulation completely to fill cavities and behind mechanical and electrical services within the plane of the insulation.
- F. All fibrous batt and board insulation shall be isolated from occupiable building spaces by gypsum board or other approved finish. Exposed insulation shall not be permitted in habitable areas.

#### **3.05 FOAM INSULATION SEALANT INSTALLATION**

- A. Install foam insulation sealant continuously to completely fill all gaps and voids at insulation boards, at voids in deck flutes, at voids around window and door frames, and at locations as indicated on the Drawings.
- B. Install foam insulation following manufacturer's instructions and recommendations. Exercise caution not to overfill voids. Insulation shall be permitted to expand without causing the deflection of adjacent materials. Use non-expanding foam at perimeters of doors and windows.

**END OF SECTION**

**SECTION 07 21 19  
FOAMED-IN PLACE INSULATION**

**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Foamed-in-place insulation for locations at the exterior wall and roof edge as indicated on the Drawings.

**1.02 RELATED REQUIREMENTS**

- A. Division 07 Section "Thermal Insulation" for insulation other than specified in this section.
- B. Division 09 Section "Gypsum Board Assemblies" for steel framing at exterior walls.

**1.03 REFERENCE STANDARDS**

- A. ASTM C1029 - Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation; 2010.
- B. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
- C. ASTM D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics; 2008.
- D. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2012.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- F. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-installation Meeting: Convene one month prior to commencing work of this Section.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, insulation properties, preparation requirements, fire test reports, VOC content, MSDS sheets, certified test reports showing compliance with specified performance values and verification of minimum foam thickness to achieve the specified R-value.
- C. Samples:
  - 1. Submit 12" x 12" sample of insulation on specified substrate.
  - 2. Submit daily test shot samples of foamed-in-place insulation from each batch of foam.
- D. Certificates:
  - 3. Certify in writing that products of this section meet or exceed specified requirements.
  - 4. Certify in writing acceptance of all substrate surfaces prior to insulation installation.
  - 5. Certify in writing installer is approved by the manufacturer.

**1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this Section, with not less than fifteen years of documented experience.
- B. Applicator Qualifications: Applicator shall be trained and certified by the insulation manufacturer, shall specialize in performing work of the type specified, with minimum five years of experience.
- C. Conform to applicable code for flame and smoke limitations.

**1.07 DELIVERY, STORAGE AND HANDLING**

- A. Materials shall be delivered in manufacturer's original sealed containers clearly labeled with manufacturer's name, product identification, safety information, net weight and expiration date.
- B. Materials shall be stored in a safe manner within temperature limits specified by the materials manufacturer.

**1.08 FIELD CONDITIONS**

- A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.
- B. Do not apply foam when temperature is within 5 F of dew point.

- C. Do not apply to unsatisfactory substrate conditions.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Foamed-In-Place Insulation: 2-component closed cell spray polyurethane foam system, non-CFC or HCFC blowing agent, ASTM C1029 Type II.
  - 1. Installed Thickness: 3 inches or as indicated on the Drawings.
  - 2. Surface Burning Characteristics, ASTM E84: Flame Spread Index of 25 or less, Smoke Developed Index of 350 or less.
  - 3. Thermal Resistance R value aged, ASTM C518: 6.7 min. per inch.
  - 4. Water Vapor Transmission, ASTM E96: 0.7 perms max. at 2" thickness.
  - 5. Air Infiltration, ASTM E283: At 1.57 psf, <0.001 cfm/sq ft; At 6.24 psf, <0.001 cfm/sq ft.
  - 6. Water Absorption, ASTM D2842: 0.60% volume.
  - 7. Compressive Strength, ASTM D1621: 26 PSI min.
  - 8. Density, ASTM D1622: 2.0 PCF.
  - 9. Dimensional Stability, ASTM D2126: -0.47% at -20 F and 5.9% at 100 F.
  - 10. Products:
    - a. Walltite by BASF
    - b. Corbond III by Johns Manville.

### **2.02 ACCESSORIES**

- A. Primer: Required, by insulation manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify work within construction spaces or crevices is complete prior to insulation application.
- B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation adhesion.
- C. Examine substrate surfaces to receive insulation system materials and conditions under which the system will be installed. Do not proceed with the Work until unsatisfactory conditions have been corrected by the Contractor in a manner acceptable to the system installer and in compliance with the system manufacturer's standards.
  - 1. Prior to beginning work, examine all substrates for soundness, such as tightness of connections, crumbling or looseness of surface, and other conditions that would affect the installation.
  - 2. Notify the Contractor and Architect of any adverse or unsatisfactory conditions. Work shall not proceed until such conditions are corrected and conditions are accepted by the insulation system contractor.
- D. The insulation contractor shall submit a certificate stating acceptance of all substrate surfaces prior to installation of the insulation system, including, but not limited to:
  - 1. Structural Steel and/or Miscellaneous Metals are clean, dry, free of ice and snow, free of oils or other contaminants, smooth, free of depressions, waves, projections and other detrimental features for the insulation system installation.
  - 2. Substrate surfaces are solidly supported and secured.
  - 3. Substrate surfaces are suitable for proper bonding of the insulation system materials.

### **3.02 PREPARATION**

- A. Mask and protect adjacent surfaces from over spray or dusting.
- B. Ventilate area to receive insulation and follow manufacturer's instructions for safe working conditions for workers and where applicable, building occupants.
- C. Apply primer in accordance with manufacturer's instructions.
- D. Verify that installed components are secured appropriately so that expansion of foam does not cause their displacement.

### **3.03 APPLICATION**

- A. Apply insulation in accordance with manufacturer's instructions. Insulation shall be installed at a thickness of no more than 2.75 inches per pass.
- B. Apply insulation by spray method, to a uniform monolithic density without voids, in consecutive passes. Observe installation tolerance from specified thickness.
- C. Measures shall be taken to contain field trimmings of over-sprayed areas. They shall be removed on a regular basis to minimize trimmings from being blown around the site.
- D. Monitor and maintain the component ratio and mix of the components of the urethane chemicals in accordance with the manufacturer's product requirements. See Field Quality Control below.
- E. Sealant is required at all locations requiring an infiltration seal, that are too small for foam sealant (1/8 inch or less).
- F. Apply to achieve minimum specified cured thickness.
- G. Patch damaged areas.
- H. It is intended that all areas of foam insulation within the building envelop shall be separated from the interior by gypsum board thermal barrier.

### **3.04 FIELD QUALITY CONTROL**

- A. Field inspections and tests shall be performed by an independent testing agency under provisions of Section 01 40 00 and shall include:
  - 1. Verification of insulation and overcoat thickness and density.
- B. Field monitoring and testing shall be performed by the insulation system contractor under provisions of Section 01 40 00 and shall include:
  - 1. Insulation system contractor shall monitor and maintain the component ratio and mix; component temperatures; in accordance with the manufacturer's product recommendations to achieve the desired density and physical properties. Verify product component ratio with flow meters and programmable ratio monitoring equipment to ensure insulation product conforms to the manufacturer's prescribed limits.
    - a. Submit monitoring records during the progress of the work on a daily basis.
  - 2. Test samples: Insulation system contractor shall submit daily test shot samples of insulation from each batch of foam. Sample size shall comply with industry standards. Samples shall be marked for date, batch number, location where installed in the building.

### **3.05 PROTECTION**

- A. Do not permit subsequent construction work to disturb applied insulation.

**END OF SECTION**

## **SECTION 07 42 43 COMPOSITE WALL PANELS**

### **PART1 - GENERAL**

#### **1.1 SECTION INCLUDES:**

- A. Exterior, panelized fiber cement cladding system and accessories to complete a drained and back-ventilated rainscreen.
- B. Interior fiber cement panelized cladding system and accessories.

#### **1.2 RELATED SECTIONS**

- A. Division 06 Section "Rough Carpentry"
- B. Division 07 Section "Thermal Insulation"
- C. Division 07 Section "Sheet Metal Flashing and Trim"

#### **1.3 REFERENCES**

- A. American Architectural Manufacturers Association (AAMA):
  - 1. AAMA 509-09 – Voluntary Test and Classification Method of Drained and Back Ventilated Rain Screen Wall Cladding Systems
- B. ASTM International (ASTM):
  - 1. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
  - 2. ASTM C 1185 - Standard Test Methods for Sampling and Testing Non-Asbestos Fiber Cement.
    - a. ASTM C 1186 – Standard Specification for Flat Fiber-Cement Sheets.
  - 3. ASTM E-84 - Standard Test for Surface Burning Characteristics of Building Materials.
  - 4. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
  - 5. ASTM E 228 - Standard Test Method for Linear Thermal Expansion of Solid Materials with a Vitreous Silica Dilatometer.
  - 6. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
  - 7. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
  - 8. ASTM G 23 - Standard Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) with and without Water for Exposure of Nonmetallic Materials, Replaced by G152 and G153.
- C. Florida Building Code - Test Protocol HVHZ
  - 1. Testing Application Standard (TAS) 201, 202, 203 – Impact Test Procedures
- D. National Fire Protection Association (NFPA):
  - 1. NFPA 285 - Fire Test Method for Exterior Wall Assemblies Containing Combustible Material.
  - 2. NFPA 268 – Ignition Resistance of Exterior Wall Assemblies.
- E. Standards Council of Canada & Underwriters Laboratories Canada (ULC):

1. CAN/ULC S-102 – Standard Method of Test for Surface Burning Characteristics.
2. CAN/ULC S-134 – Standard Method of Fire Test of Exterior Wall Assembly.

#### **1.4 SUBMITTALS**

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Submit manufacturer's product description, storage and handling requirements, and installation instructions.
- C. Product Test Reports and Code Compliance: Documents demonstrating product compliance with local building code, such as test reports or Evaluation Reports from qualified, independent testing agencies.
- D. LEED Credits: Provide documentation of LEED Credits for project certification under USGBC LEED 2009 (Version 3.0) or 2012 v.4.
- E. Manufacturer's Details: Submit drawings (.dwg, .rvt, and/or .pdf formats), including plans, sections, showing installation details that demonstrate product dimensions, edge/termination conditions/treatments, compression and control joints, corners, openings, and penetrations.
- F. Samples: Submit samples of each product type proposed for use.

#### **1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications:
  1. All fiber cement panels specified in this section must be supplied by a manufacturer with a minimum of 10 years of experience in fabricating and supplying fiber cement cladding systems.
    - a. Products covered under this section are to be manufactured in an ISO 9001 certified facility.
  2. Provide technical and design support as needed regarding installation requirements and warranty compliance provisions.
- B. Installer Qualifications: All products listed in this section are to be installed by a single installer trained by manufacturer or representative.
- C. Mock-Up Wall: Provide a mock-up wall as evaluation tool for product and installation workmanship.
- D. Pre-Installation Meetings: Prior to beginning installation, conduct conference to verify and discuss substrate conditions, manufacturer's installation instructions and warranty requirements, and project requirements.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Panels must be stored flat and kept dry before installation. A waterproof cover over panels and accessories should be used at all times prior to installation.
- B. If panels are exposed to water or water vapor prior to installation, allow to completely dry before installing. Failure to do so may result in panel shrinkage at ship lap joints, and such action may void warranty.

C. Panels MUST be carried on edge. Do not carry or lift panels flat. Improper handling may cause cracking or panel damage.

D. Direct contact between the panels and the ground should be avoided at all times. It is necessary to keep panels clean during installation process.

### **1.7 WARRANTY**

A. Provide manufacturer's 15-year warranty against manufactured defects in fiber cement panels. Additional 5-year extension available when refinished in year 14-15.

B. Provide manufacturer's 15-year warranty against manufactured defects in panel finish.

C. Warranty provides for the original purchaser. See warranty for detailed information on terms, conditions and limitations.

## **PART II: PRODUCTS**

### **2.1 MANUFACTURERS**

A. Acceptable Manufacturer: Nichiha Corporation, 18-19 Nishiki 2-chome Naka-ku, Nagoya, Aichi 460-8610, Japan.

B. Acceptable Manufacturer's Representative: Nichiha USA, Inc., 6465 E. Johns Crossing, Suite 250, Johns Creek, GA 30097. Toll free: 1.866.424.4421, Office: 770.805.9466, Fax: 770.805.9467, [www.nichiha.com](http://www.nichiha.com).

1. Basis of Design Product: Nichiha Illumination Series.

a. Profile colors: Designer-specified custom color (finished in U.S.).

b. Profiles:

1. AWP-1818 Panel: Smooth, no score lines.

2. AWP-3030 Panel: No score lines. Wider, soft-U chamfered edge at horizontal joints.

i. Do not pair the different sizes directly together.

c. Accessory/Component Options:

i. Manufactured Corners with 3-1/2" returns for each profile size and color.

a. Do not use AWP-1818 Corners with AWP-3030 Panels.

ii. Aluminum trim to be painted per finish schedule: Outside corners (Corner Key, Open Outside Corner), vertical joints (H-Mold), terminations (J-Mold)

iii. Essential Flashing System: Starter, Compression Joint, Overhang.

d. Dimensions:

1. AWP-1818: 455mm (17-7/8") (h) x 1,818 mm (71-9/16") (l).

2. AWP-3030: 455mm (17-7/8") (h) x 3,030 mm (119-5/16") (l).

e. Panel Thickness: 16 mm (5/8").

f. Finish: Matte, smooth.

g. Weight: AWP-1818: 35.27 lbs. per panel, AWP-3030: 57.32 lbs. per panel.

h. Coverage: 8.88 sq. ft. per panel (1818), 14.81 sq. ft. per panel (3030).

i. Factory sealed on six [6] sides.

C. Substitutions: Not permitted.

D. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

## **2.2 MATERIALS**

A. Fiber cement panels manufactured from a pressed, stamped, and autoclaved mix of Portland cement, fly ash, silica, recycled rejects, and wood fiber bundles.

B. Panel surface pre-finished and machine applied.

C. AWP-1818 profiled along all four edges, such that both horizontal and vertical joints between the installed panels are ship-lapped.

D. Factory-applied sealant gasket added to top and right panel edges; all AWP-1818 joints contain a factory sealant.

## **2.3 PERFORMANCE REQUIREMENTS:**

A. Fiber Cement Cladding – Must comply with ASTM C-1186, Type A, Grade II requirements:

1. Wet Flexural Strength, lower limit: 1015 psi.
2. Water Tightness: No water droplets observed on any specimen.
3. Freeze-thaw: No damage or defects observed.
4. Warm Water: No evidence of cracking, delamination, swelling, or other defects observed.
5. Heat-Rain: No crazing, cracking, or other deleterious effects, surface or joint changes observed in any specimen.

B. Mean Coefficient of Linear Thermal Expansion (ASTM E-228): Max  $1.0 \times 10^{-5}$  in./in. F.

C. Surface Burning (CAN-ULC S102/ASTM E-84): Flame Spread: 0, Smoke Developed: 5.

D. Wind Load (ASTM E-330): Contact manufacturer for ultimate test pressure data corresponding to framing type, dimensions, fastener type, and attachment clips. Project engineer(s) must determine Zone 4 and 5 design pressures based on project specifics.

1. Minimum lateral deflection: L/120.

E. Water Penetration (ASTM E-331): No water leakage observed into wall cavity.

F. Weather Resistant (ASTM G-23): No cracking, checking, crazing, erosion, or other detrimental effects observed.

G. Steady-State Heat Flux and Thermal Transmission Properties Test (ASTM C-518): thermal resistance R Value of 1.23.

H. Fire Resistant (ASTM E-119): The wall assembly must successfully endure 60-minute fire exposure without developing excessive unexposed surface temperature or allowing flaming on the unexposed side of the assembly.



I. Ignition Resistance (NFPA 268): No sustained flaming of panels, assembly when subjected to a minimum radiant heat flux of 12.5 kW/m<sup>2</sup> ± 5% in the presence of a pilot ignition source for a 20-minute period.

J. Fire Propagation (NFPA 285): Wall assembly of Nichiha AWP, Ultimate Clips and Starter Track, Tyvek Commercial Wrap, ½" Densglass Gold Sheathing, 16" o.c. 18 gauge steel studs, mineral wool in-cavity insulation, and interior 5/8" Type X gypsum met the acceptance criteria of NFPA 285.

K. Fire Propagation (CAN/ULC S-134): Wall assembly of Nichiha AWP, Ultimate Clips and Starter Track, Tyvek Housewrap, 5/8" FRT plywood, 16" o.c. 2x wood studs, fiberglass in-cavity insulation, and interior 5/8" Type X gypsum met the acceptance criteria of CAN/ULC S-134.

L. Drained and Back Ventilated Rainscreen (AAMA 509-09): System must pass all component tests.

M. Florida Building Code - Test Protocol HVHZ (TAS 201, 202, 203): Passed.

## 2.4 INSTALLATION COMPONENTS

### A. Ultimate Clip System:

1. Starter Track:
  - a. Horizontal Panel Installations - FA 700 – 3,030mm (I) galvalume coated steel.
2. Panel Clips: JEL 777 "Ultimate Clip" (10mm rainscreen for 16mm AWP) – Zinc-Aluminum-Magnesium alloy coated steel.
  - a. Joint Tab Attachments (included) – used at all AWP-1818 panel to panel vertical joints. NOT used with AWP-3030 installations.
3. Single Flange Sealant Backer – FHK 1017 (10mm) – 6.5' (I) fluorine coated galvalume.
4. Double Flange Sealant Backer – FH 1020 (10mm) – 10' (I) fluorine coated galvalume.
5. Corrugated Spacer – FS 1005 (5mm), FS 1010 (10mm) – 4' (I).
6. Finish Clip (optional) – JE310 (5mm)

### B. Aluminum Trim (optional): Paint as specified in finish schedule.

### C. Essential Flashing System (optional):

1. Starter – main segments (3,030mm), inside corners, outside corners
2. Compression Joint – main segments (3,030mm)
3. Overhang – main segments (3,030mm), inside corners, outside corners, joint clips

### D. Fasteners: Corrosion resistant fasteners, such as hot-dipped galvanized screws appropriate to local building codes and practices must be used. Use Stainless Steel fasteners in high humidity and high-moisture regions. Panel manufacturer is not liable for corrosion resistance of fasteners. Do not use aluminum fasteners, staples or fasteners that are not rated or designed for intended use. See manufacturer's instructions for appropriate fasteners for construction method used.

### E. Flashing: Flash all areas specified in manufacturer's instructions. Do not use raw aluminum flashing. Flashing must be galvanized, anodized, or PVC coated.

### F. Sealant: Sealant shall comply with ASTM C920, Class 35.

## PART III: EXECUTION

### 3.1 EXAMINATION

#### A. Verification of Conditions:

1. Fiber cement panels can be installed over braced wood, steel studs and sheathing including plywood, OSB, plastic foam or fiberboard sheathing. Fiber cement panels can also be installed over Structural Insulated Panels (SIP's), Concrete Masonry Units (CMU's) and Concrete Block Structures (CBS's) with furring strips, and Pre-Engineered Metal Construction. Insulated Concrete Forms (ICFs) are **NOT** an approved substrate under any condition.
2. Allowable stud spacing: 16" o.c. maximum.
3. A weather resistive barrier is required when installing fiber cement panels. Use an approved weather resistive barrier (WRB) as defined by the 2015 IBC or IRC. Refer to local building codes.
4. Appropriate metal flashing should be used to prevent moisture penetration around all doors, windows, wall bottoms, material transitions and penetrations. Refer to local building codes for best practices.

#### B. Examine site to ensure substrate conditions are within alignment tolerances for proper installation.

#### C. Do not begin installation until unacceptable conditions have been corrected.

#### D. Do not install panels or components that appear to be damaged or defective. Do not install wet panels.

### 3.2 TOLERANCE

#### A. Wall surface plane must be plumb and level within +/- ¼ inch in 20 feet in any direction.

1. One layer of Nichiha 5mm (~3/16") Spacer may be used as shim.

### 3.3 INSTALLATION

#### A. General: Install products in accordance with the latest installation guidelines of the manufacturer and all applicable building codes and other laws, rules, regulations and ordinances. Review all manufacturer installation, maintenance instructions, and other applicable documents before installation.

1. Consult with your local dealer or Nichiha Technical Department before installing any Nichiha fiber cement product on a building higher than 45 feet or three stories or for conditions not matching prescribed standard installation guide requirements and methods. Special installation conditions may be required via a **Technical Review and Special Applications Form (SAF)** process.

2. **Vertical Control/Expansion Joints** are required within 2-10 feet of outside corners finished with metal trim *and* approximately every 30 feet thereafter.

3. **Horizontal/Compression Joints** are required for multi-story installations of AWP. Locate joints at floor lines. Joints are flashed minimum ½" breaks. Do not caulk. Refer to installation guide(s).

A. Wood framed buildings of three or more floors require a compression joint at each floor.

B. Steel framed buildings (including reinforced concrete core with LGMF exterior walls) of more than three floors (or 45 feet) require a compression joint every 25 feet at a floor line.

**B. Panel Cutting**

1. Always cut fiber cement panels outside or in a well ventilated area. Do not cut the products in an enclosed area.

2. Always wear safety glasses and NIOSH/OSHA approved respirator whenever cutting, drilling, sawing, sanding or abrading the products. Refer to manufacturer SDS for more information.

3. Use a dust-reducing circular saw with a diamond-tipped or carbide-tipped blade.

a. Recommended circular saw: Makita 7-1/4" Circular Saw with Dust Collector (#5057KB).

b. Recommended blade: Tenryu Board-Pro Plus PCD Blade (#BP-18505).

c. Shears (electric or pneumatic) or jig saw can be used for complicated cuttings, such as service openings, curves, radii and scrollwork.

4. **Silica Dust Warning:** Fiber cement products may contain some amounts of crystalline silica, a naturally occurring, potentially hazardous mineral when airborne in dust form. Consult product SDS or visit <https://www.osha.gov/dsg/topics/silicacrystalline/>.

**3.4 CLEANING AND MAINTENANCE**

A. Review manufacturer guidelines for detailed care instructions.

**SECTION 07 62 00  
SHEET METAL FLASHING AND TRIM**

**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Manufactured and shop fabricated sheet metal items, including flashings, counter-flashings, and drip edges.
- B. Sealants for joints within sheet metal fabrications.
- C. Reglets and accessories.

**1.02 RELATED REQUIREMENTS**

- A. Division 06 Section "Rough Carpentry" for wood blocking for metal flashings.
- B. Division 07 Section "EPDM Single Ply Membrane Roofing".

**1.03 REFERENCE STANDARDS**

- A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.
- B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.
- C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
- E. SMACNA - Architectural Sheet Metal Manual; 2012.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-installation Meeting: Convene at least two weeks before starting work of this Section.

**1.05 PERFORMANCE REQUIREMENTS**

- A. General: Install flashings that are watertight; will not permit the passage of liquid water; and will withstand wind loads, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

**1.06 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details. Key into roof plan shop drawing, see roofing Section.
- C. Samples:
  - 1. Submit samples each 4x4 inch in size, illustrating metal materials, thickness, and colors.

**1.07 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 ten years of documented experience.

**1.08 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.

**1.09 WARRANTY**

- A. The flashing and roofing subcontractor hereby guarantees that roof metalwork, flashings, roofing,

roof insulation and roof accessories will be free from defective materials and workmanship for a period of two (2) years from the date of Substantial Completion. Upon notification of any such defects within said guarantee period the roofing and flashing subcontractor shall promptly make all necessary repairs and replacements at no cost or expense to the Owner. This warranty shall be signed and countersigned by the installer (Roofer) and the Contractor.

- B. Metal Flashings Warranty under Roofing Manufacturer's Total System Warranty: See Section 07 55 00 – Modified Bituminous Membrane Roofing
- C. Pre-finished Aluminum: Finish shall be warranted against premature failure for twenty years.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Pre-Finished Aluminum: ASTM B209; 0.032 inch thickness or as otherwise indicated; plain finish shop pre-coated with fluoropolymer coating.
  - 1. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system; Kynar or Duranar by PPG.
  - 2. Color: As selected by Architect from manufacturer's standard colors.
  - 3. All roof edge metal work shall have been ANSI/SPRI ES-1 tested.
  - 4. For Total System Warranty projects, metalwork shall be as approved by the membrane roofing manufacturer.

### **2.02 ACCESSORIES**

- A. Fasteners: Stainless steel.
- B. Protective Backing Paint: Zinc molybdate alkyd.
- C. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.
- D. Sealant to be Exposed in Completed Work: ASTM C920; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.
- E. Fasteners for Aluminum: Stainless steel ring nails; 12 gage with 1/4" diameter, flat head, annular threaded, needle point, length as required to obtain 1-1/4" embedment into blocking/framing and full depth into plywood.
- F. Anchors for Flashing to Concrete or Masonry: 1/4" diameter, lengths as required to obtain 1-1/2" penetration into masonry backup. Unless otherwise indicated, provide 3 inch edge distance.
  - 1. Product: Nylon Nail-in with stainless steel drive pin manufactured by Powers Fasteners Inc.
- G. Plastic Cement: ASTM D 4586, Type I.

### **2.03 FABRICATION**

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.. Form on a bending brake. Perform shaping, trimming, and hand seaming in the shop to the maximum extent possible.
- 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. Form metal with full regard for expansion and contraction to avoid buckling or other deformation in service. All lines and arrisses shall be straight and crisp except where thickness of metal dictates radius bend.
- E. Immediately prior to soldering, mechanically clean all metal to be soldered with steel wool or other acceptable means, apply flux and pre-tin. Solder shop formed metal joints. Perform all soldering slowly with well heated heavy irons with properly tinned clean blunt tips. Do not use torches. Apply enough heat to sweat the solder completely through the full width of the seam. Close clinch lock seams gently with a block of wood and mallet, then flux and show at least one full inch of continuous and evenly flowed solder. Whenever possible, perform all soldering in flat position. All sloped and vertical seams shall be laced and soldered a second time. After soldering, remove flux. Wipe and wash solder joints clean. Weather seal joints.
- F. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

- G. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- H. Pre-fabricate corners with joints locked, riveted and soldered watertight, and where indicated from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- I. Unless indicated otherwise, provide expansion joints at 24 feet on centers maximum and at 2 feet from all changes in flashing direction (each side) and from all terminations of flashing.
- J. Space rivets 1 inch on center unless indicated otherwise.
- K. Provide backer plates as required at through-wall flashing transitions and corners to fully solder watertight. Backer plates shall be continuous to cover gaps to be overlain by membrane flashing at all deck and column to wall transitions. Secure to framing or plywood at 6" centers and within 1/2" of corners and edges.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. 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. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.
- C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

### **3.03 GENERAL REQUIREMENTS FOR METAL FLASHING**

- A. Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather, without failing. Fabricate and install flashings and roof edges to fully comply with the recommendations of Factory Mutual (FM) Loss Prevention Data Sheet 1-49 for the applicable wind zone.
- B. Schedule and coordinate sheet metal installations with the work of other trades where it is integral or continuous therewith. Materials furnished under this Section that are to be built-in by other trades shall be delivered to the site in sufficient time to avoid delays to construction progress. Instruct other trades concerning the location and placement of reglets, wood nailers, and cleats.
- C. Surfaces to which roofing and sheet metal are to be applied shall be even, smooth, sound, thoroughly clean and dry and free from projecting nail heads or other defects that would affect the application. Report in writing any unsatisfactory surfaces to the Contractor.
- D. Where flashing abuts or members into adjacent dissimilar metals, the juncture shall be executed in a manner that will facilitate drainage and thus minimize the possibility of galvanic action. Note: All metalwork shall be isolated from contact with pressure treated wood products, using roofing membrane, felts, or approved coatings.
- E. All accessories or other items essential to the completeness of the sheet metal installation, though not specifically shown or specified, shall be provided. All such items, unless otherwise indicated on Drawings or specified, shall be of the same kind of material as the item to which applied and the gauges shall conform to recognized industry standards of sheet metal practice.
- F. Provide expansion joints in sheet metal work at intervals not greater than forty (40') feet. Expansion joints shall be fabricated in accordance with the recommendations of the Architectural Sheet Metal Manual (SMACNA) and as specified herein.
  - 1. Begin expansion joint construction by setting an 8" wide cleat. Lapp ends of metal work over base sheet, leaving 1/2" clear space between butt ends. Set ends in full bed of sealant. Cover entire joint assembly with a 4 inch wide metal cover, finish to match other metal work

and secured allowing for movement.

- G. Fabricate and install sheet metal with lines, arises, and angles sharp and true and plane surfaces free from objectionable wave, warp, or buckle. Exposed edges of sheet metal shall be folded back to form a 1/2" wide hem on the side concealed from water leakage under all weather conditions. The workmanship and methods employed for framing, anchoring, cleating, and the expansion and contraction of sheet metal work shall conform to applicable details and description as indicated in current edition of the following publications unless other methods are indicated on project Drawings or specified herein.
  - 1. Architectural Sheet Metal Manual as published by the Sheet Metal and Air Conditioning Contractors National Association, Inc., and hereinafter referred to as "The SMACNA Manual".
  - 2. Handbook of Sheet Copper Fundamentals, Design, Details and Specifications as published by Copper Development Association, Inc., latest Edition.
- H. All ferrous metal work shall be zinc coated and finished as specified elsewhere herein. Touch-up all field cuts and minor scratches with approved zinc rich primer and finish coat to match adjacent finishes.
- I. All metal work terminating on roofing shall be provided with flanges for nailing. Wood nailers shall be provided beneath flanges and roofing for nailing of the metal flanges.
- J. Provide cleats, edge and drip strips where sheet metal extends over edges and where necessary to secure sheet metal work at fascias and elsewhere. Form edge strips in lengths of 8' or 10'. The ends shall be butted together, leaving approximately 1/4" space for expansion. Secure to building construction with fasteners spaced not over 12" on centers. Install strips in continuous, long lengths to allow metal work to be hooked over lower edge at least 1/2".
- K. Flash intersections of roofs with vertical surfaces as detailed and indicated on the Drawings, or otherwise required to provide watertight construction and to suit job conditions.
- L. Seams shall always be made in direction of flow.
- M. Fabricated fascias shall be sized and shaped to profiles indicated, using sheets 8' to 10' long. Lower edge shall hook a minimum of 1/2" over previously placed continuous edge cleats.

### **3.04 INSTALLATION**

- A. Conform to drawing details. Installations shall conform to SMACNA Architectural Sheet Metal Manual recommendations and National Roofing Association Manual recommendations.
- B. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.
- C. Apply plastic cement compound between metal flashings and felt flashings.
- D. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

### **3.05 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

### **3.06 SCHEDULE**

- A. Miscellaneous Flashings: Aluminum:.040 or as required, unless otherwise indicated on Drawings.

### **3.07 CLEANING AND PROTECTION**

- A. Clean all metalwork to remove all fingerprints, oils, etc.
- B. Remove from roof surfaces all scraps and metal debris immediately. Extreme care shall be exercised to prevent sharp metal scraps or waste nails from coming into contact with membrane materials.

**END OF SECTION**

**SECTION 07 84 00  
FIRESTOPPING****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Firestopping systems for all penetrations and interruptions to fire-rated assemblies, whether indicated on drawings or not, and other openings indicated.
- B. Identification signage.

**1.02 RELATED REQUIREMENTS**

- A. Division 22 - Plumbing: Firestopping of plumbing work.
- B. Division 23 - HVAC: Firestopping of heating, ventilating and air conditioning work.
- C. Division 26 - Electrical: Firestopping of electrical work.

**1.03 REFERENCE STANDARDS**

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2014.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a.
- C. ASTM E1966 - Standard Test Method for Fire Resistive Joint Systems; 2011.

**1.04 DEFINITIONS**

- A. Annular Space is the opening around an item (pipe, duct, etc.) penetrating a construction assembly.
- B. Fire-resistance is the property of materials or their assemblies that prevents or retards the passage of excessive heat, hot gases, or flames under conditions of use.
- C. Fire-resistive joint system is the assemblage of specific materials or products that are designed, tested and fire-resistance rated in accordance with ASTM E119 to resist for a prescribed period of time the spread of fire through joints in or between fire-resistance rated assemblies.
- D. Firestopping is a specific assembly of materials or products fill openings and annular spaces around penetrating items (such as cables, cable trays, conduits, ducts, pipes) and their means of support through the wall, floor, ceiling or roof to prevent spread of fire and includes fire-resistive joint systems and through-penetration firestop systems.
- E. Through-penetration is an opening that passes entirely through a fire-resistance rated assembly.
- F. Through-penetration firestop system is a specific assembly of materials that are designed, tested and installed to prevent the spread of fire through openings in fire-resistive rated floors and walls to accommodate through-penetrations of electrical, mechanical, plumbing, and communications systems.
- G. "F" rating indicates the period of time that the through-penetration firestop system is capable of preventing the passage of flame to the unexposed (non-fire) side of the assembly in conjunction with an acceptable hose stream test performance.
- H. "T" rating indicates the period of time that the through-penetration firestop system is capable of preventing the passage of flame and temperature rise of 325 degrees F. above ambient temperature on the unexposed (non-fire) side of the assembly in conjunction with an acceptable hose stream test performance.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance ratings, and limitations. A coordinated submittal shall be prepared for all firestopping used on the Project.
- C. Shop Drawings: Submit manufacturer's illustrated test assembly shop drawings detailing materials, installation methods, and relationships to adjoining construction for each through-penetration firestop system and fire-resistant joint system, each construction condition and type of penetration or joint. Include firestop design designation from the approved testing agency (UL, for



example).

1. For those firestop applications for which no tested system is available from the manufacturer, the manufacturer's engineering judgment derived from similar tested system designs or other tests shall be submitted to the Authority Having Jurisdiction for their review and approval prior to installation.
  2. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
  3. One firestopping submittal shall cover products used for all phases of multi-phase projects.
- D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- E. Installer Qualifications: Submit qualification statements for installing mechanics.

#### **1.06 QUALITY ASSURANCE**

- A. Single Source: If the Contractor determines that individual trades (i.e. mechanical, plumbing, fire protection, electrical) shall be responsible for firestopping their penetrations, instead of all firestopping provided by a single contractor, products used shall be coordinated among the various trades by the Contractor so that multiple products or manufacturers are NOT used for the same type of application.
1. The Contractor shall provide a coordinated submittal for all firestopping used on the Project.
- B. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
1. Listing in the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) 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.
  3. For those firestop applications that exist for which no approved tested system is available through a manufacturer, an engineered judgment derived from similar system designs or other approved tests shall be submitted to the local Authority Having Jurisdiction for review and approval prior to installation. Engineering judgment drawings shall follow requirements set forth by the International Firestop Council.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum ten years documented experience.
- D. Installer Qualifications: Company or personnel specializing in performing the work of this Section, trained by the firestop manufacturer(s) and with a minimum of 3 years documented experience installing work of this type. Submit written qualifications statements for installing mechanics.

#### **1.07 MOCK-UP**

- 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.
  2. Where firestopping is intended to fill a linear opening, install minimum of 1 linear ft.
- B. Obtain approval of authority having jurisdiction and testing agency before proceeding.
- C. Remove and replace unsatisfactory mock-ups. Accepted mock-ups shall represent minimum standards for the Work.
- D. Accepted mock-ups may remain as part of the Work.

#### **1.08 FIELD CONDITIONS**

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

### **PART 2 PRODUCTS**

#### **2.01 FIRESTOPPING GENERAL REQUIREMENTS**

- A. Firestopping: All products shall be by one of the following acceptable manufacturers and shall be specific for each construction condition, fire-resistance requirement, and annular size. Multiple products shall not be used for the same application. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- B. Basis of Design: Hilti Inc.
- C. Acceptable Manufacturers:
  - 1. 3M Fire Protection Products.
  - 2. Tremco, Inc.; Tremco Fire Protection Systems Group.
  - 3. A/D Fire Protection Systems, Inc.
  - 4. Nelson FireStop Products.
  - 5. Specified Technologies, Inc.
  - 6. Bio Fireshield, Carlise, MA.
  - 7. RectorSeal Corp.
  - 8. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.
- E. Fire Ratings: See Drawings for required systems and ratings.

## **2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS**

- A. Provide firestop systems manufactured and installed to resist spread of fire, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated for:
  - 1. Fire rated load-bearing walls and non-load bearing partitions.
  - 2. Fire rated floor assemblies and roof assemblies
  - 3. Fire rated smoke barriers.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa). Fire-resistance-rated walls include fire walls and fire-barrier walls.
  - 1. F-ratings as determined by ASTM E814, but not less than that equaling or exceeding fire resistance rating of the construction penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
  - 1. Horizontal assemblies include floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
  - 2. F-Rating: At least 2 hour, but not less than the fire-resistance rating of constructions penetrated.
  - 3. T-Rating: At least 2 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
  - 4. Provide firestop systems with T-ratings in addition to F-ratings as determined by ASTM E814, where systems protect penetrations located outside wall cavities, located outside fire-resistive shaft enclosures, located in construction containing fire protection rated openings and at penetrating items larger than 4 inches in diameter pipe or 16 sq inches cross sectional area.
- D. For firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
  - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant firestop systems.
  - 2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
  - 3. For penetrations involving insulated piping, provide firestop systems not requiring removal of insulation.
  - 4. For firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed.

- E. Provide firestop systems that are compatible with one another and the substrates they are in contact with based on testing and field experience.
- F. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the VOC limit contents per 40 CFR 59, Subpart D (EPA Method 24):
  - 1. Sealants: 250 g/L.
  - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
  - 3. Sealant Primers for Porous Substrates: 775 g/L.
- G. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.
- H. Mold Resistance: Provide firestopping materials with mold and mildew resistance rating of 0 as determined by ASTM G21.
- I. Head-of-Wall Firestopping at Joints Between Non-Rated Floor and Fire-Rated Wall: Use any system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
  - 1. Movement: In addition, provide systems that have been tested to show movement capability as indicated.
    - a. Coordinate with Section 09 21 16 - Gypsum Board Assemblies for deflection head tracks at fire-rated assemblies with greater than 1/2 inch of movement.

### 2.03 OTHER MATERIALS

- A. Accessories: Provide components for each firestop system that are needed to install fill materials and to comply with performance requirements. Use only components specified by firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
  - 1. Permanent forming/damming/backing materials, including the following:
    - a. Slag/rock-wool-fiber insulation.
    - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
    - c. Fire-rated form board.
    - d. Fillers for sealants.
    - e. Substrate primers.
    - f. Collars.
    - g. Steel sleeves
- B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrating item.
- E. Intumescent Putties: Non-hardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags.
- I. Silicone Foam: Multi-component, silicone-based liquid elastomer that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants, pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and non-sag formulation for openings in vertical and other surfaces requiring a non-slumping, gunnable sealant, unless indicated firestop system limits use to non-sag grade for both opening conditions.

- K. Caulking Compound (fire sealant): Material approved by the safing insulation manufacturer for sealing joints between foil backing of safing insulation and edge of concrete floor slab against smoke penetration.
- L. Safing Clips: Galvanized steel safing clips approved by the safing insulation manufacturer for holding insulation in place.
- M. Sleeves for through-penetrations shall be of non-combustible materials and securely fastened to the assembly penetrated. Sleeves through floors in exposed locations, behind kitchen cooking line equipment for piping and conduit, for example, shall extend 1" above the floor surface to stop water seepage to floor below.
- N. Identification Signage: Pressure sensitive self-adhesive, preprinted vinyl labels; including the following information on labels:
  - 1. "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Contractor's name, address, phone number.
  - 3. Firestop system designation of applicable testing and inspecting agency (UL or WH).
  - 4. Date of installation.
  - 5. Firestop system manufacturer's name.
  - 6. Installer's name.
- O. Primers: Type required for tested assembly design.
- P. Fiber Firestopping Insulation (Safing Insulation): Mineral fiber batt, unfaced insulation used in conjunction with elastomeric surface sealer forming airtight bond to opening; conforming to ASTM C 665 Type 1.
  - 1. Density, ASTM D 1622: 4 lb/cu ft min.
  - 2. Max. Water Absorption, ASTM C 272: 0.1% by volume.
  - 3. Durability and Longevity: Permanent.
  - 4. Fire Resistance, ASTM E84: Flame spread: 15; Smoke Developed: 0.
  - 5. Manufacturer's "Z" impaling clips as required
  - 6. Product for Curtainwalls: Foil faced Thermafiber Curtainwall Insulation by USG.
  - 7. Products:
    - a. Thermafiber by United States Gypsum Co.
    - b. Safing Insulation / MW by Owens Corning Insulation.
    - c. FBX Safing Insulation by Fibrex Insulations, Inc.
    - d. Safe by Roxul Inc.

#### **2.04 FIRESTOPPING ASSEMBLY REQUIREMENTS**

- A. Perimeter Fire Containment Firestopping: Use any system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of the floor assembly.
  - 1. Movement: In addition, provide systems that have been tested to show movement capability as indicated.
  - 2. Air Leakage: In addition, provide systems that have been tested to show L Rating as indicated.

### **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 matter 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. Coordinate with mechanical, fire protection, electrical, and other trades to assure that all pipes, conduits, cable trays, cables, ducts, and other items that penetrate fire-resistant construction are properly firestopped.
- C. Install dams where recommended or required by tested fire-resistive joint assemblies and through-penetration firestop systems. Combustible damming material and other accessories not indicated as permanent components of firestop systems shall be removed after appropriate curing.
- D. Install firestopping materials in conjunction with fiber firestopping insulation (firesafing insulation) as required by tested assemblies.
- E. Where cable trays penetrate fire-resistant wall assemblies, provide pillow type firestop product. All cabling /wiring sleeves whether empty or utilized for wiring through fire-resistant assemblies shall be firestopped.
- F. Do not cover installed firestopping until inspected by Authority Having Jurisdiction and/or testing agency.
- G. In general, for fire containment at perimeter curtainwall systems, firesafing insulation shall be mechanically attached to curtainwall mullions and transoms using impaling pins, screws or other positive mechanical attachment as required. Install in strict accordance with the manufacturer's tested assemblies and recommendations. Firesafing insulation shall be compression fit into the floor line void between floor structure and curtainwall firesafing, supported with "Z" clips. Coordinate with the work of Section 07 84 00 - Firestopping
  - 1. Install a light gage steel angle or channel continuously behind the insulation and attached to the vertical mullions at the floor firesafing line to prevent bowing of the curtainwall insulation due to compression of the firesafing insulation at the floor line. Exposed curtainwall mullions shall be protected with firesafing mullion covers.
  - 2. Install insulation between aluminum framing members and other surfaces with insulation fitting snugly to prevent settling. All voids and gaps shall be completely filled.
  - 3. Firestopping shall be installed on the floor line firesafing insulation. Installations shall be in accordance with UL tested assemblies.

### **3.04 CLEANING**

- A. Clean adjacent surfaces of firestopping materials.

### **3.05 IDENTIFICATION**

- A. Identify all firestop system locations with pressure sensitive self-adhesive, pre-printed vinyl labels.
  - 1. Attach labels permanently to both sides of penetrated construction surfaces and joints in fire-rated construction.
  - 2. Labels shall be visible to anyone seeking to disturb or remove penetrating items or firestop system. Where possible, labels shall be installed above finished ceilings. Where installed in exposed locations, labels shall be neatly located.
  - 3. Labels for horizontal joints shall be installed at a maximum spacing of ten (10) feet.

### **3.06 FIELD QUALITY CONTROL**

- A. Prepare and install firestopping systems in accordance with manufacturer's shop drawings, tested assemblies and instructions
  - 1. Follow safety procedures recommended in Material Safety Data Sheets.
  - 2. Finish all firestopping surfaces that are to remain exposed in the completed Work to a uniform and level condition.
- B. Firestopping materials and installations at joints and penetrations in fire-resistive rated assemblies and smoke barrier assemblies shall not be concealed from view until inspected and approved by the Authority Having Jurisdiction or, if designated, by the Owner's testing agency. Such inspection shall include partial destructive inspection to determine compliance with tested firestop assembly requirements. All such locations shall be repaired or replaced by the Contractor at no additional cost to the Owner.
  - 1. All firestopping locations shall be visually inspected.
  - 2. At a minimum, not less than 5% of all firestopping joints and penetrations shall be

- inspected by removal of materials to determine conformance to assembly requirements.
- C. Inspections by the AHJ and /or the testing agency shall not relieve the Contractor of responsibility for providing his own inspections and quality control in compliance with specified requirements.
  - D. Inspections shall be performed as required by the building code, the Construction Documents or as otherwise directed by the Architect.
  - E. The Contractor shall cooperate with individuals conducting such inspections. The Contractor shall notify inspectors at least five (5) days in advance of requested inspection date. All identification labeling, firestopping and smoke sealing work shall be completed prior to inspection.
  - F. Any non-compliant materials shall be removed and replaced. Any locations missing required protection shall be corrected by the Contractor and re-inspected prior to concealing such areas with other construction. Any material or workmanship that is rejected shall be corrected and /or replaced promptly by the Contractor to the satisfaction of the inspector and/or Architect, and at no additional cost to the Owner.

**3.07 PROTECTION**

- A. Clean adjacent surfaces of firestopping materials. Leave work in a neat and clean condition.
- B. Protect adjacent surfaces from damage by material installation.

**END OF SECTION**

**SECTION 07 90 00  
JOINT SEALANTS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Sealants and joint backing.
  - 1. Exterior joints between masonry and frames of openings
  - 2. Interior perimeter joints of exterior openings
  - 3. Interior perimeter joints between interior wall surfaces and dissimilar materials.
  - 4. Joints between fixtures, counter and adjoining walls.
- B. Compressible fillers.

**1.02 RELATED REQUIREMENTS**

- A. Division 07 Section "Firestopping" for firestopping sealants.
- B. Division 07 Section "Sheet Metal Flashing and Trim" for sealants at sheet metal fabrications.
- C. Division 08 Section "Glazing" for glazing sealants and accessories.
- D. Division 08 Section "Surface Mounted Polycarbonate Skylight System".
- E. Division 09 Section "Gypsum Board Assemblies" for acoustical sealants.
- F. Division 09 Section "Tile" for sealant used as tile grout.

**1.03 REFERENCE STANDARDS**

- A. ASTM C834 - Standard Specification for Latex Sealants; 2014.
- B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.
- E. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with other Sections referencing this Section.

**1.05 PERFORMANCE REQUIREMENTS**

- A. Provide elastomeric joint sealants that have been produced and installed to establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joints sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

**1.06 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating sealant chemical characteristics.
- C. Samples: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- D. Manufacturer's Installation Instructions: Indicate special procedures.

**1.07 QUALITY ASSURANCE**

- A. Maintain one copy of each referenced document covering installation requirements on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this Section with minimum twenty five years documented experience.
- C. Applicator Qualifications: Company specializing in performing the work of this Section with minimum five years of experience. Where applicable, applicators shall be approved by their respective material manufacturers as licensed applicators. All applicators shall be skilled personnel who are thoroughly trained and experienced in the necessary skills, completely familiar with the specific requirements of the Work.

**1.08 FIELD CONDITIONS**

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.
- B. Do not proceed with application of materials when surface or air temperatures are less than 40 degrees F or likely to drop to below 40 degrees F in the following 24 hours after sealant installation.
- C. Do not apply materials unless surface to receive coating is clean and dry, or if precipitation is imminent.
- D. Do not proceed with installation of joint sealants where joint widths are less than allowed by joint manufacturer for application indicated.
- E. Coordination: It shall be the responsibility of the Contractor to properly coordinate the Work of this Section with that of all other trades in order to ensure the providing of complete and continuous sealing and consistent use of products specified herein.

**1.09 WARRANTY**

- A. See Section 01 78 10 - Warranties, for additional warranty requirements.
- B. Warranty:
  - 1. Include coverage for installed sealants and accessories which fail to achieve airtight seal and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.
    - a. Urethane Sealants: Five years.
    - b. Silicone Sealants: Twenty years, unless otherwise indicated with product description.
  - 2. Provide manufacturer's non-stain warranty.
- C. The installer shall provide an installation warranty that all Sealing shall be free of defects of materials and workmanship for two (2) years; and shall repair and/or replace such defective work, during the warranty term, without extra cost to the Owner.
  - 1. The following types of sealing failures will be considered defective Work: Leakage, loosening, loss of bond, hardening, cracking, crumbling, melting, shrinking, running, sagging, improper tooling, discoloration, or staining of adjacent work.

**PART 2 PRODUCTS****2.01 MANUFACTURERS**

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

**2.02 SEALANTS**

- A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No. 1168.
  - 1. Sealant Types:
    - a. M - Multi-component.
    - b. S - Single component.
    - c. P - Pourable or self-leveling for traffic joints
    - d. NS - Non-sag or gunnable for vertical and non-traffic joints.
    - e. FC - Fast cure.
  - 2. Sealant Classes:
    - a. 25, 50 and 100/50 (extension/compression) represent movement capability in percent of joint width.
  - 3. Sealant Uses:
    - a. T - Traffic
    - b. NT - Non-Traffic
    - c. I - Immersion
    - d. M - Mortar
    - e. A - Aluminum



- f. O - Other (includes steel, painted surfaces, wood, brick, stone, tile)
- B. General Purpose Exterior Sealant: Silicone, ASTM C920, Type S, Class 50 or 100, Uses T, NT, A, G, M, O; single component, neutral curing, non-sagging, non-staining, non-bleeding, ultra-low-modulus.
  - 1. Shore A Hardness Range: 15.
  - 2. Applications: High movement joints.
    - a. Joints between concrete and other materials.
    - b. Joints between metal frames and other materials.
    - c. Joints between dissimilar materials and building construction.
    - d. Control, expansion, and soft joints in stone, masonry, pre-cast concrete.
  - 3. Joint size: 1/4" min to 3" max width and 1/4" min to 1/2" max depth.
  - 4. Note: Compatibility with materials sealant shall be in contact with shall be verified prior to use.
  - 5. Limitations: Not for use in structural applications, below grade or to materials that outgas, on brass, copper, or materials that can corrode, at joints continuously immersed in water, interior firestop sealing, at materials that bleed oils, plasticizers, or solvents, in confined spaces, to surfaces that will be painted, to surfaces in contact with food, to wet surfaces, to architectural finishes without prior testing, and as otherwise limited by the manufacturer.
  - 6. Basis of Design: 756 by Dow Corning Corp.
- C. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
  - 1. Applications: For minimal movement.
    - a. Interior wall and ceiling control joints.
    - b. Joints between door and window frames and wall surfaces, where minimal movement is expected and will receive field painting.
    - c. Interior sound sealing, non-fire rated smoke sealing where little movement is anticipated.
    - d. Other interior joints between dissimilar materials.
  - 2. Note: Compatibility with materials sealant shall be in contact with shall be verified prior to use.
  - 3. Limitations: Not for use at joints subject to dynamic movement, submerged in water, and as otherwise limited by the manufacturer.
  - 4. Products:
    - a. Acrylic Latex 834 by Tremco Inc.
    - b. AC-20 + Silicone Acrylic Latex Caulking Compound by Pecora Corp.
- D. Plumbing Fixture/Tile Sealant: Silicone; ASTM C920; single component, mildew resistant, color selected by Architect.
  - 1. Applications: For minimal movement.
    - a. Sealant between plumbing fixtures and walls and floors
    - b. Sealant between countertops and walls
  - 2. Products:
    - a. 898 Silicon; Pecora Corporation
    - b. Tremsil 200, Tremco, Inc.

### 2.03 JOINT-SEALANT BACKING

- A. General: Provide sealant backings (backer rods) of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Plastic Foam Joint Fillers (Backer Rods): Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials. Provide self-adhesive tape where applicable.

## **2.04 MISCELLANEOUS MATERIALS**

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.
- B. Notify the Contractor of conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected by the Contractor to meet acceptable industry standards in a manner acceptable to the Architect.
- C. Verify that joint backing and release tapes are compatible with sealant.

### **3.02 PREPARATION**

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Protect elements surrounding the work of this section from damage or disfigurement. Mask off adjoining surfaces as needed to prevent surface damage.

### **3.03 INSTALLATION**

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Perform acoustical sealant application work in accordance with ASTM C919.
- D. Sealing at Acoustical Construction: At construction designated "Acoustical Construction" seal around all joints and pipe, conduit, structural member, duct, and electrical box openings to gypsum wallboard or masonry as applicable. Seal bottom of gypsum wallboard partitions to floor slabs. Seal tops of masonry and gypsum wallboard partitions to decks (including voids at fluted decks), and seal sides of partitions to abutting construction. Note: Sealing related to installation of partition framing members and gypsum wallboard is specified under Section 09 21 16 - Gypsum Board Assemblies.
- E. Non-Fire Rated Smoke Sealing: At building assemblies identified as non-fire rated smoke barriers, seal all joints and pipe, conduit, structural member, duct and electrical box openings. Openings above finish ceilings or other concealed locations may be sealed on one side only. All openings and annular spaces shall be backed with fire safing insulation prior to installation of sealant.

- F. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.
- G. Do not leave gaps between ends of joint backers. Do not twist, stretch or tear backers.
- H. Install bond breaker where joint backing is not used. Back rods shall be 25% wider than the joint width.
- I. Application of Sealant: Sealant shall be gun-applied through a nozzle opening of such diameter so that the full bead of sealant is gunned into the joint, filling the joint completely. A superficial or skin bead will not be acceptable.
  - 1. Sealant geometry (depth to width ratios) shall be as recommended by the manufacturer for each specific application.
  - 2. Beads shall be tooled immediately after application to ensure firm, full contact with the inner faces of the joint. Excess material shall be struck off with a tooling stick or knife.
  - 3. The finished bead shall be smooth, properly contoured and flush with the adjacent surface, or as otherwise indicated.
  - 4. Remove all excess materials and smears adjacent to the joint as work progresses. All materials shall be used in accordance with the manufacturer's printed instructions.
- J. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- K. Apply sealant when joint is cool to minimize chances of delamination and wrinkles.
- L. Tool joints concave.
- M. Fillers: Avoid joints except at ends, corners, and intersections; seal all joints with adhesive; install with face 1/8 to 1/4 inch below adjoining surface.

#### **3.04 FIELD QUALITY CONTROL**

- A. Perform stain tests in accord with manufacturer's instructions and ASTM C1248 on mock-up joints prior to start of job installation.
- B. Perform adhesion tests in accord with manufacturer's instructions and ASTM C1193, Method A, Field Applied Sealant Joints Hand Pull Test.
  - 1. Perform tests on mock-up joints prior to start of job installation.
  - 2. Perform a minimum of 1 test for every 200 linear feet of applied sealant and one (1) test per floor per building elevation minimum.
  - 3. For sealant applied to dissimilar materials, test both sides of the joint.
- C. Sealant failing test shall be removed, surfaces cleaned, resealed and retested.
- D. Maintain a test log and submit report to the Architect indicating tests, locations, dates, results and remedial action.

#### **3.05 CLEANING AND PROTECTION**

- A. Clean adjacent soiled surfaces. Protect sealants until cured.

**END OF SECTION**

**SECTION 07 90 00  
EXPANSION JOINT ASSEMBLIES**

**PART 1 – GENERAL**

**1.01 Work Included**

- A. The work shall consist of furnishing and installing waterproof expansion joints in accordance with the details shown on the plans and the requirements of the specifications. Preformed sealant shall be silicone pre-coated, preformed, pre-compressed, self-expanding, sealant system.
- B. Related Work
  - 1. Division 4 Section "Unit Masonry"
  - 2. Division 7 Section "Joint Sealants" for sealants, caulking and waterproofing
  - 3. Division 8 Section "Wood Windows and Stile and Rail Doors" for wood storefront.

**1.02 Submittals**

- A. General – Submit the following according to Division 1 Specification Section.
- B. Standard Submittal Package – Submit typical expansion joint drawing(s) indicating pertinent dimensions, general construction, expansion joint opening dimensions and product information.
- C. Sample of material is required at time of submittal.
- D. All products must be certified by independent test report to exceed the requirements of curtain wall performance tests ASTM E330, E283-04, and E331. Product must meet or exceed hurricane-force wind loading with no deflection at both positive and negative pressures up to 4954 Pascals - equal to 200 mph winds (ASTM E330-02-procedure A).
- E. All products must be certified by independent laboratory test report to ASTM E-90 and to meet or exceed an STC 54 in STC 56 wall and OITC 38 rating in an OITC 38 wall.
- F. All products must be certified by independent laboratory test report to be free in composition of any waxes or wax compounds using FTIR and DSC testing.
- G. All products shall be certified in writing to be: a) capable of withstanding 150°F (65°C) for 3 hours while compressed down to the minimum of movement capability dimension of the basis of design product (-50% of nominal material size) without evidence of any bleeding of impregnation medium from the material; and b) that the same material after the heat stability test and after first being cooled to room temperature will subsequently self-expand to the maximum of movement capability dimension of the basis-of-design product (+50% of nominal material size) within 24 hours at room temperature 68°F (20°C).
- H. Quality and Environmental control: Manufacturer shall be certified to both ISO-9001:2015 (quality management) and ISO-14001:2015 (environmental management), and shall provide written confirmation that formal Quality and Environmental management systems and processes have been adopted.

**1.03 Product Delivery, Storage and Handling**

- A. Deliver products to site in Manufacturer's original, intact, labeled containers. Handle and protect as necessary to prevent damage or deterioration during shipment, handling and storage. Store in accordance with manufacturer's installation instructions.
- 1.04 Basis-of-Design
- A. All joints shall be designed to meet the specified performance criteria of the project as manufactured by: (USA & International) EMSEAL JOINT SYSTEMS, LTD 25 Bridle Lane, Westborough, MA 01581-2603, Toll Free: 800-526-8365.  
(Canada) EMSEAL, LLC 120 Carrier Drive, Toronto, Ontario, Canada M9W 5R1 Toll Free: 800-526-8365. [www.emseal.com](http://www.emseal.com)
  - B. Alternate manufacturers must demonstrate that their products meet or exceed the design criteria and must submit certified performance test reports performed by nationally recognized independent laboratories as called for in section 1.02 Submittals. Submittal of alternates must be made three weeks prior to bid opening to allow proper evaluation time.
- 1.05 Quality Assurance
- A. The General Contractor will conduct a pre-construction meeting with all parties and trades involved in the treatment of work at and around expansion joints including, but not limited to, concrete, mechanical, electrical, HVAC, landscaping, masonry, curtain wall, waterproofing, fire-stopping, caulking, flooring and other finish trade subcontractors. All superintendents and foremen with responsibility for oversight and setting of the joint gap must attend this meeting. The General Contractor is responsible to coordinate and schedule all trades and ensure that all subcontractors understand their responsibilities in relation to expansion joints and that their work cannot impede anticipated structural movement at the expansion joints, or compromise the achievement of watertightness or life safety at expansion joints in any way.
  - B. Warranty – Manufacturer's standard warranty shall apply.

## **PART 2 – PRODUCT**

- 2.01 General
- A. Provide watertight, energy-efficient exterior and interior joints in vertical-plane walls (above-grade) and with multiple silicone-coated sealing faces provided in one integrated primary system. Typical locations include, but are not limited to the following applications: parapets, curtain-wall systems, doorways, window-walls, interior partitions as a sound barrier, etc.
  - B. Provide SEISMIC COLORSEAL-DS as manufactured by EMSEAL JOINT SYSTEMS LTD and as indicated on drawings for vertical expansion joint locations.
  - C. Preformed sealant shall be silicone pre-coated, preformed, pre-compressed, self-expanding, sealant system. Expanding foam to be cellular foam impregnated with a water-based, non-drying, 100% acrylic dispersion. Seal shall combine factory-applied, low-modulus silicone and a backing of acrylic-impregnated expanding foam into a unified hybrid sealant system.
  - D. Material shall be capable of movements of +50%, -50% (100% total) of nominal material size

- E. Multiple silicone external color facings to be factory-applied to the foam while it is partially pre-compressed to a width greater than maximum joint extension and cured before final compression. When compressed to final supplied dimension, a bellow(s) to handle movement must be created in the silicone coatings. Silicone coatings to be available in a range of not less than 26 standard colors for coordination with typical building materials.
  - F. Select the sealant system model appropriate to the movement and design requirements at each joint location that meet the project specification or as defined by the structural engineer of record.
  - G. Manufacturer's Checklist must be filled out by expansion joint subcontractor and returned to manufacturer at time of ordering material.
- 2.02 Fabrication
- A. SEISMIC COLORSEAL-DS by EMSEAL JOINT SYSTEMS LTD must be supplied pre-compressed to less than the joint size, packaged in shrink-wrapped lengths (sticks) with a mounting adhesive on one face.
  - B. Directional changes and terminations into horizontal plane surfaces to be provided by factory-manufactured universal-90-degree single units containing minimum 12-inch long leg and 6-inch long leg or custom leg on each side of the direction change or through field fabrication in strict accordance with installation instructions.

### **PART 3 – EXECUTION**

#### **3.01 Installation**

- A. Preparation of the Work Area
  - 1. The contractor shall provide properly formed and prepared expansion joint openings constructed to the exact dimensions and elevations shown on manufacturer's standard system drawings or as shown on the contract drawings. Deviations from these dimensions will not be allowed without the written consent of the engineer of record.
  - 2. The contractor shall clean the joint opening of all contaminants immediately prior to installation of expansion joint system. Repair spalled, irregular or unsound joint surfaces using accepted industry practices for repair of the substrates in question. Remove protruding roughness to ensure joint sides are smooth. Ensure that there is sufficient depth to receive the full depth of the size of the SEISMIC COLORSEAL-DS being installed plus at least ¼-inch (6mm) for the application of corner beads. Refer to Manufacturers Installation Guide for detailed step-by-step instructions.
  - 3. No drilling, or screwing, or fasteners of any type are permitted to anchor the sealant system into the substrate.

#### **3.02 Clean and Protect**

- A. Protect the system and its components during construction. Subsequent damage to the expansion joint system will be repaired at the general contractor's expense. After work is complete, clean exposed surfaces with a suitable cleaner that will not harm or attack the finish.

**END OF SECTION**

**SECTION 08 11 13  
HOLLOW METAL DOORS AND FRAMES**

**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Hollow metal doors and frames.
- B. Hollow Metal frames for wood doors.

**1.02 RELATED REQUIREMENTS**

- A. Section 08 14 16 - Flush Wood Doors.
- B. Section 08 71 00 - Door Hardware.
- C. Section 08 80 00 - Glazing
- D. Section 09 90 00 - Painting and Coating: Field painting.

**1.03 REFERENCE STANDARDS**

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, cores, sound ratings, profiles, anchorage and fastening methods, and finishes.
- C. Shop Drawings: Include the following:
  - 1. Elevations of each door design.
  - 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
  - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  - 4. Provide dimensions for proper edge clearances of doors, including meeting stiles for pairs of doors going into metal frames.
  - 5. Locations of reinforcement and preparations for hardware.
  - 6. Details of each different wall opening condition.
  - 7. Details of anchorages, joints, field splices, and connections.
  - 8. Details of accessories.
  - 9. Details of moldings, removable stops, and glazing.
- D. Samples: Submit samples of typical frame, door section, glazing frame and loose stop, upon request.
- E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum ten years documented experience.
- B. Door Frame Inspection: Contractor with Installer shall inspect each door frame, checking frame for squareness, alignment, twist, and plumbness before installation of wallboard to assure proper fit of doors with correct clearances and operation without modification to the door. Frames that are out of tolerance shall be reinstalled to requirements.
- C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes installation requirements.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Inspect doors and frames on delivery for damage; notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.
- D. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Do not store in a manner that traps excess humidity.
  - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

#### **1.07 PROJECT CONDITIONS**

- A. Field Measurements: Verify actual dimensions of openings and dimensions of existing framing by field measurements before fabrication.

#### **1.08 COORDINATION**

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate dimensions for proper edge clearances of wood and metal doors.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Hollow Metal Door and Frame Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ceco Door Products; an Assa Abloy Group company
  - 2. Curries Company; an Assa Abloy Group company
  - 3. Steelcraft; an Ingersoll-Rand company.
  - 4. JR Metal Frames Manufacturing, Inc.
  - 5. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.02 MATERIALS**

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- E. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-



spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

G. Glazing: Comply with requirements in Division 08 Section "Glazing."

## **2.03 HOLLOW METAL DOORS**

- A. Door Finish: Factory primed and field finished.
- B.. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8, unless more stringent requirements are specified.
  - 1. Design: Flush panel.
  - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core. Provide internal sound deadener on inside of face sheets.
  - 3. Vertical Edges for Doors: Beveled edge.
    - a. Beveled Edge: 1/8 inch in 2 inches.
  - 4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.
  - 5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Thermally insulated.
  - 1. Grade: ANSI A250.8 - SDI-100; Level 3 - Extra Heavy-Duty, Physical Performance Level A, Model 2 - Seamless (16 gage).
    - a. Exception: Grade for all doors in frame openings over 72" wide: Level 4, physical performance Level A, Model 2, seamless (14 gage).
    - b. Thermal Performance: U 0.29; R 3.4 for door, thermally-broken frame and threshold assembly.
  - 2. Non-Fire Rated Door Core: Polystyrene foam block, spanning the full thickness of the interior spaces of the door and securely attached to the faces using an epoxy glue.
  - 3. Fire Rated Door Core: Non-asbestos mineral fiberboard.
  - 4. Door Thickness: 1-3/4 inch, nominal.
  - 5. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653, with A60/ZF180 coating.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates of sufficient strength from same material as door face sheets to support hardware without through bolting and to comply with the following minimum sizes:
  - 1. Hinges: Minimum 0.123 inch thick, 10 gage, by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
  - 2. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch thick, 8 gage.
  - 3. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick, 8 gage.

## **2.04 HOLLOW METAL FRAMES**

- A. General: Comply with ANSI/SDI A250.8 or ANSI/NAAMM-HMMA 861, and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
  - 1. Fabricate frames with mitered or coped corners and seamless face joints.
  - 2. Fabricate frames as full profile welded, unless otherwise indicated.
    - a. All welded joints shall be ground and dressed to be smooth, flush, and invisible.
  - 3. Frames for Level 3 Steel Doors: 0.053-inch- thick, 16 gage, steel sheet.
  - 4. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653, with A60/ZF180 coating.
- C. Interior Frames: Fabricated from cold-rolled steel sheet.

1. Frames : Fabricate frames as face welded with mitered or coped corners[ and seamless face joints].
  2. Frames for Level 2 Steel Doors: 0.053-inch- thick, 16 gage, steel sheet.
  3. All welded joints shall be ground and dressed to be smooth, flush, and invisible.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates of sufficient strength from same material as frames to support hardware without through bolting and to comply with the following minimum sizes:
1. Hinges: Minimum 0.123 inch thick, 10 gage, by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
  2. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch thick, 14 gage.
  3. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick, 14 gage.
  4. Fabricate concealed stiffeners and hardware reinforcement plates from same material as frames.
  5. Locate hardware reinforcement plates as indicated on Shop Drawings or, if not indicated, according to ANSI/SDI A250.6.

## 2.05 FRAME ANCHORS

- A. Jamb Anchors:
1. Stud-Wall Type: Slip in wood stud anchor; not less than 0.053 inch thick, 16 gage.
  2. Compression (Pressure-fit) Type: Not permitted.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, 18 gage, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

## 2.06 STOPS AND MOLDINGS

- A. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.
- B. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, 22 gage, fabricated from same material as frames in which they are installed.

## 2.07 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- C. Hollow Metal Doors:
1. Interior Door and Panel Faces: Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from cold-rolled steel sheet, unless otherwise indicated.
  2. Pairs of Doors: Size pairs of doors to provide the following maximum gap between leaves to permit proper functioning of dead latching feature:
    - a. Non-Rated Doors: Maximum 3/16-inch gap.
  3. Glazed Lites: Factory cut openings in doors.
  4. Coordinate door undercut to provide 1/2 inch clearance from top of floor covering.

- D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
  2. Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
    - a. Field verify existing frames and match dimensions and profiles.
  3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor. Provide floor anchors for all frames. Floor anchors are in addition to jamb anchors.
  5. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      - 1) Three anchors per jamb up to 60 inches high.
      - 2) Four anchors per jamb from 60 to 90 inches high.
      - 3) Five anchors per jamb from 90 to 96 inches high.
      - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
      - 5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
  6. Door Silencers: Except on doors with smoke seals, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
  7. Provide welded frames with temporary spreader bars for shipping. Shipping spreader bars to be removed before installation, with template jig used to properly square up and space jambs.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated on Shop Drawings, or if not indicated, according to ANSI/SDI A250.8.
  2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware. Through bolting will not be acceptable.
  3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
  4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.
- G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
  2. Provide loose stops and moldings on inside of hollow metal work.
  3. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

## 2.08 STEEL FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - 1. Apply primers to hollow metal doors and frames after assembly.
  - 2. Doors and frames shall be factory primed to assure proper preparation and bond of primer. Bare galvanized or galvanized steel for field priming not permitted.
- B. Comply with SSPC-PA1, "Paint Application Specification No. 1," for steel sheet finishes.
- C. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- D. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.
  - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION AND PREPARATION**

- A. The Contractor shall take all measurements, make all investigations, and in general, provide field work and coordination as required to ensure the proper fit of all Work specified herein. Frames shall be sized, positioned, and installed in accordance with the design intent represented on the Drawings. The design intent shall not be modified due to the Contractor's failure to provide coordination or obtain properly fabricated materials. Such coordination shall be provided sufficiently in advance so as to avoid delays in the construction schedule.
- B. Verify that opening sizes and tolerances are acceptable. It shall be the responsibility of the Contractor to coordinate frame thicknesses with each wall and partition type to ensure proper fit.
- C. Verify that finished walls are in plane to ensure proper door alignment.
- D. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

### **3.02 PREPARATION**

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
  - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
  - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
  - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

- C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
- D. Hollow metal door frames installed in exterior walls shall be filled with rigid insulation before installing.

### 3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames for doors of size and profile indicated. Comply with ANSI/SDI A250.11 and HMMA 840.
  - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    - a. Where frames are fabricated in sections because of shipping or handling limitations, and where sections tie into existing frames, field splice by welding exposed joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    - b. Install frames with removable glazing stops located on secure side of opening.
    - c. Remove shipping straps at bottom of frames. Properly space frame using wood template that is full depth of frame and of proper spacing width during setting and anchoring of frames to maintain proper width, with frame plumb and square without twists. Remove temporary braces necessary for installation only after frames have been properly set and secured. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
    - d. Set bottom of frames at required elevations to provide proper undercut clearance of factory fit doors.
    - e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
  - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors. Floor anchors are in addition to wall anchors.
    - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
  - 3. Stud Partitions: Attach wall anchors to studs with screws. Provide floor anchor at each jamb, in addition to the wall anchors.
  - 4. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
    - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- D. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
  - 1. Non-Fire-Rated Standard Steel Doors:
    - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    - b. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    - c. Between Bottom of Door and Top of Finish Floor (No Threshold): Max. 5/8".

E. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

### **3.04 ADJUSTING AND CLEANING**

- A. Final Adjustments: Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer. Apply primer to field modifications of existing hollow metal work.

### **3.05 SCHEDULE**

- E. Refer to Door and Frame Schedule on the Drawings.

**END OF SECTION**

## **SECTION 08 14 16 WOOD DOORS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Factory finished flush wood Section Includes:
  - 1. Solid-core doors with wood-veneer faces.
  - 2. Factory finishing wood doors.
  - 3. Factory fitting wood doors to frames and factory machining for hardware.
    - a. Coordination for the installation of wood doors in existing HM frames.
  - 4. Factory glazing of wood doors with glazed openings.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 08 11 13 - Hollow Metal Doors and Frames.
- B. Section 08 71 00 - Door Hardware.
- C. Section 08 80 00 - Glazing: Site glazing of doors.

#### **1.03 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics. Submit manufacturer's certification of compliance with quality standards.
- 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.
- D. Specimen warranty.
- E. Samples:
  - 1. Upon request, submit one sample of door construction, 8x8 inch in size cut from top corner of door and samples of lite frame section.
  - 2. Submit one full set of manufacturer's standard stain colors on specified veneer for selection.
  - 3. Submit two samples of door veneer, 6x6 inch in size illustrating selected wood grain, stain color, and sheen.
  - 4. Samples submitted and accepted shall serve to reflect the entire range of (color, texture, grain and sapwood/heartwood variation and shall be used as the standard for acceptance or rejection of installed materials.
- F. Manufacturer's certification that products are manufactured in the United States.
- G. Manufacturer's Installation Instructions: Indicate special installation instructions.

#### **1.04 QUALITY ASSURANCE**

- A. Source Limitations: Obtain all wood doors from single manufacturer.
- B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Protect materials during transit, storage, and handling to prevent deterioration, damage and soiling. Package each door at the factory in a separate heavy sealed poly bag. Mark each bag at top and bottom of doors for location to correspond with opening number on the Drawings.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage. In the event of damage, immediately make all repairs and replacements necessary for approval of the Architect and at no additional cost to the Owner.

- C. Protect doors with resilient packaging. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation. Deliver door to job site only when building is dry and has reached average prevailing relative humidity of locality.
- D. Coordinate the work with door opening construction, door frame and door hardware installation. The Contractor shall take all measurements, make all investigations, and in general provide field work and coordination as required to ensure the proper fit of all Work specified herein. Doors and frames shall be sized, positioned and installed in accordance with the design intent represented on the Drawings. The design intent shall not be modified due to the Contractor's failure to provide coordination or obtain properly fabricated materials. Such coordination shall be provided sufficiently in advance so as to avoid delays in the construction schedule.

## **1.06 WARRANTY**

- A. General: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
    - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
  - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
  - 3. Warranty shall be in effect during the following period of time from date of Substantial Completion:
    - a. Warranty Period for Solid-Core Interior Doors: Life of installation.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Algoma Hardwoods, Inc.
  - 2. Eggers Industries.
  - 3. Marshfield Door Systems, Inc.
  - 4. VT Industries Inc.

### **2.02 DOOR CONSTRUCTION, GENERAL**

- A. WDMA I.S.1-A Performance Grade: Heavy Duty.
- B. Structural-Composite-Lumber-Core Doors:
  - 1. Structural Composite Lumber: WDMA I.S.10.
    - a. Screw Withdrawal, Face: 700 lbf.
    - b. Screw Withdrawal, Edge: 400 lbf.

### **2.03 VENEERED-FACED DOORS FOR TRANSPARENT FINISH**



- A. Interior Solid-Core Doors:
  - 1. Grade: Premium, with Grade A faces.
  - 2. Species: Select white birch.
  - 3. Cut: Plain sliced (flat sliced).
  - 4. Match between Veneer Leaves: Slip match.
  - 5. Assembly of Veneer Leaves on Door Faces: Running match.
  - 6. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
  - 7. Exposed Vertical Edges: Same species as faces.
  - 8. Core: Structural composite lumber.
  - 9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.
  - 10. WDMA I.S.1-A Performance Grade: Heavy Duty.

## **2.04 LIGHT FRAMES**

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.
  - 1. Wood Species: Same species as door faces .
  - 2. Profile: Manufacturer's standard shape.

## **2.05 GLAZING IN DOORS**

- A. Safety Glass for Non-Rated Doors: ASTM C 1048; Kind FT (fully tempered), Condition A (uncoated), Type I (transparent flat glass); Class 1 (clear); Quality q3 (glazing select); conforming to ANSI Z97.1; 6 mm (0.23 inch) minimum thick.

## **2.06 FABRICATION**

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
  - 1. Coordinate sizing of pairs of doors to provide the following maximum gap between leaves:
    - a. Non-Rated Doors: Maximum 3/16-inch gap.
  - 2. Field verify existing wood frame sizes and configurations scheduled to receive new wood doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
  - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
  - 2. Coordinate location of hardware mortises in existing metal frames with hardware locations in new wood doors being installed in an existing frame.
- C. Openings: Cut and trim openings through doors in factory.
  - 1. Light Openings: Trim openings with moldings of material and profile indicated.
  - 2. Glaze doors at factory with glass of type and thickness indicated. Secure glass in place with removable stops.

## **2.07 FACTORY FINISHING**

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication,

including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, and exposed edges,.
- B. Finish doors at factory.
- C. Transparent Finish:
1. Grade: Premium .
  2. Finish: UV-curable polyurethane.
  3. Sheen: Satin.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.02 INSTALLATION**

- A. Hardware: For installation, see Division 08 Section "Door Hardware."
1. Hinges shall be shimmed with metal shims at each door to provide equal clearance at each jamb.
  2. Locks, exit devices, door closers and other hardware shall be installed in accordance with the manufacturer's instructions. Pilot holes of recommended size for wood screws required to fasten hardware shall be drilled by installing Contractor before screws are fastened to wood doors.
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge. Coordinate pairs of doors to provide the following maximum gap between leafs:
1. Non-Rated Doors: Maximum 3/16-inch gap.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

#### **3.03 ADJUSTING**

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

#### **3.04 SCHEDULE**

A. Refer to Door and Frame Schedule on the Drawings.

**END OF SECTION**

**SECTION 08 14 00**  
**EXTERIOR STILE AND RAIL WOOD DOORS AND WINDOWS**

**PART 1 — GENERAL****1.01 SUMMARY****A. Section includes:**

1. Doors: Fixed and operable wood stile and rail door systems including single swing and paired swing with factory glazed components and reinforcing as required.
2. Windows: Fixed frame, fixed sash, storefront, casement, hopper, awning, tilt/turn, and/or single-hung type operating sash, all with factory glazed components and reinforcing as required.
3. Trims (if applicable).
4. Flat steel mullion stiffeners (if applicable).
5. All labor equipment, materials to furnish and perform work as specified and shown on contract documents.

**B. Related Sections**

1. Division 05 – Structural Steel Framing
2. Section 061053 – Rough Carpentry: Wood framing or blocking
5. Section 076000 – Flashing and Sheet Metal
6. Section 079200 – Joint Sealants: Perimeter sealants and backup materials
7. Section 085200 – Wood Windows
8. Section 087100 – Door Hardware
9. Section 088000 – Glazing
10. Section 099300 – Painting for staining and transparent finishes

**1.02 SYSTEM REQUIREMENTS****A. General Qualifications:** Wood stile and rail doors shall withstand the effects of the performance requirements indicated without failure due to defective manufacture, fabrication or installation.

1. Fabricator: Single fabricator regularly engaged for at least ten years fabricating products of the kind and quality required for the project.
2. Installer: Experienced carpenter contractor who has completed comparable work.

**B. Design Criteria**

1. Manufacturer is responsible for designing system, including anchorage to structural system and necessary modifications to meet specified requirements and maintain visual design concepts.
2. Wall openings: Accommodate allowable building wall construction tolerances and moisture-caused brick masonry swell without stressing or deforming door units or overstressing anchorage.
3. Moisture changes: Accommodate wood shrinking and swelling caused by ambient conditions at the project, without stressing window units, overstressing anchorage, causing sash to bind, or exceeding air/water entry limits.
4. Comply with applicable provisions in AAMA/WDMA I.S. 2, "Standard Specification for Windows, Doors and Skylights" for operating force, air infiltration, water penetration, structural performance, and forced-entry resistance for wood stile and rail doors.
5. Glazing provisions: As recommended by the glass manufacturer.

**C. Reference Standards**

1. ASTM E 283 Test method for determining air leakage.
3. ASTM E 331 Test method for determining water penetration using static air pressure differential.

4. ASTM E 547 Test method for determining water penetration using cyclic air pressure differential.
6. ASTM E 783-02 Standard test method for field measurement of air leakage through installed exterior windows and doors.
7. AAMA 501.3 Field check of water and air leakage through installed exterior windows, curtain walls and doors by uniform air pressure difference.
8. AWI: *Architectural Woodwork Quality Standards*, 7th edition, version 1.0, 1997, of the Architectural Woodwork Institute.
9. AAMA/WDMA/CSA 101/I.S.2/A440-05 *Standard/Specification for Windows, Doors and Unit Skylights*.

### 1.03 PERFORMANCE REQUIREMENTS

- A. Performance Requirements, hardware provided and installed under Section 087100:
  1. Air Infiltration: Doors not warranted against air infiltration.
  2. Water Infiltration: Doors not warranted against water infiltration.
  3. Forced-Entry Resistance: Doors not warranted against forced entry.
  4. Thermal Transmittance: Provide window units with the following U-value as determined according to NFRC 100 or calculated according to LBNL Window 5.2 computer analysis.
    - a. U-value = .42 minimum
- C. Structural Requirements: When tested in accordance with ASTM E330 at 150 percent of design pressure, no failure or permanent deflection in excess of 0.003 of any member's span after removing the imposed load, for a positive (inward) and negative (outward) design pressure of 60 psf.

### 1.04 SUBMITTALS

- A. Wood Samples: Duplicate pairs of samples for each species of unfinished and transparent finished wood proposed for production work.
  1. Samples shall be large enough to accurately show typical appearance characteristics.
  2. Each pair of samples shall show extremes of appearance characteristic of range proposed for the work. Wood used for production shall be within this range.
- B. Sample Doors and Windows/Mock-Ups (where specified): Door and window assemblies for typical wall openings shall be provided, complete and ready to install.
- C. Shop Drawings
  1. Schedule: Door and window types, sizes, locations, and quantities, keyed to scale elevations. Identify materials, finish and species of woods, glazing types, hardware, and anchoring provisions.
  2. Details: Full or large scale, keyed to scale elevations. Show frame and panel construction, glazing, weep/vent provisions, hardware, weather-stripping and anchorage.
  3. Installation: Clearly show relation to adjoining construction. Give blocking requirements, clearances, weather proofing & flashing recommendations and all other instructions necessary for proper installation.

### 1.05 QUALITY ASSURANCE

- A. Single Source Responsibility:
  1. Provide window and door systems that are products of a single manufacturer.
  2. Glass, glazing, and glazing sealants for window and door systems are required as work of this section for single source responsibility.
- B. Certifications

1. Fabricator qualifications: Not less than 10 years prior successful production of units similar to those required. List projects having doors of the kind required for the project. Installations shall have been done to meet job conditions and performance requirements of the kind shown and specified for this project. Give installation dates, locations, contact names, addresses, and phone numbers for each project.
2. Test report: Certified independent testing agency reports to show compliance with specified door performance requirements. Tests shall have been made within 5 years of submission. Reports shall include test descriptions and results, as well as sufficient product descriptions to show that tested products are representative of those proposed for the project.
3. Installer Qualifications: Certified in writing by manufacturer with documented experience on at least 5 projects of similar nature in past 5 years.

C. Maintenance Instructions: Two copies of door manufacturer's product manual with recommendations for routine owner maintenance of door units, hardware and wood finishes; and instructions for removing and replacing panel and glass.

#### **1.06 DELIVERY, STORAGE AND HANDLING**

- A. Deliver factory-assembled, pre-glazed doors and windows in enclosed vans. Bundle and label loose materials as necessary to prevent loss and damage.
- B. Store products in a clean, protected, dry, well-ventilated building, on platforms or blocking at least 4 inches above floor. Stack products so they do not warp, bend or twist. Store doors upright, not flat or leaning, with at least ¼" air space between units. General contractor is responsible for storage on site.
- C. Protect glazing and frame components from adverse job conditions before, during, and after installation including but not limited to:
  1. Condensation, temperature changes, direct exposure to sun or other causes that could otherwise damage the assemblies
  2. The work of other trades before, during, and after installation (e.g., weld slag, run down staining, masonry dust and similar)
  3. Adhere to glass manufacturer's recommendations for venting and sealing insulated units to avoid hermetic seal ruptures or glass breakage at high altitude locations.
- D. Handle doors and windows with clean hands or canvas gloves.

#### **1.07 PROJECT CONDITIONS**

- A. Connecting Work: Constructed to specified tolerances. Field dimensions agreed upon prior to fabrication.
- B. Reference Points: Benchmarks and other required reference points shall be established.
- C. Environmental Conditions: Air temperature during installations shall be at least 40° F and rising, and the wind light or still. Work areas and materials shall be dry and free of ice and snow. Ensure ambient and surface temperatures and joint conditions are suitable for installation of materials.

#### **1.08 WARRANTY**

- A. Provide written warranty signed by manufacturer stating that work is free from defective materials, defective workmanship, glass breakage due to defective design, and agreeing to replace components which fail under normal operation.
  1. Material and workmanship warranty term: 3 years from date of Substantial Completion.

- B. Provide written warranty agreeing to replace defective insulating glass units and stating that insulating glass units will be free from condensation, fogging and obstruction of vision due to film on internal surfaces for 10 years from date of installation. Replacement includes labor and materials.

1. Glass seal failure warranty term: 10 years from date of Substantial Completion.

## **PART 2 — PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Basis of Design: Duratherm Corporation, 720 Main Street, Vassalboro, ME 04989  
Telephone: (800) 996-5558 / Email: [info@durathermwindow.com](mailto:info@durathermwindow.com).

- B. Other Acceptable Manufacturers: Subject to compliance with requirements listed herein, provide either the named product or a comparable product that meets visual, physical and performance criteria as judged solely by the architect.

### **2.02 FRAME MATERIALS**

- A. Lumber: All pieces shall be dried to an average moisture content of 12% (9-14% for individual pieces) before assembly and treatment.
- B. Wood Species: Different species at interior and exterior
1. Exterior: Extension sill nosing, exterior frame and panel facing.
    - a. African Mahogany (*Khaya ivorensis*)
  2. Interior: All inside frame and sash components.
    - a. African Mahogany (*Khaya ivorensis*)

### **2.03 HARDWARE**

- A. Anchor Bolts and Screws: Hex head through-bolts and flat head wood screws shall be of corrosion resistant type (zinc chromate, galvanized or stainless steel).
- B. Waterproof Adhesive: Resorcinol, melamine, or polyvinyl acetate emulsion type.
- C. Anchor Clips: Teco, Simpson Strong-Tie Connectors®, or equal.
- D. Operating Hardware
1. All swing door hardware furnished under Section 087100, Door Hardware, for installation in field by others.
- E. Weather-Stripping: Extruded ethylene propylene, neoprene or other plastic that remains flexible and non-sticky at project ambient temperature extremes.

### **2.04 FABRICATION**

- A. General
1. Door panels, swing: AWI Premium grade, produced from standard components. Stiles and rails shall be glued block construction with 1/8" minimum veneers. Joinery shall be dowelled construction, sized for drive fit and set in adhesive. Glazed doors to incorporate interior removable glass stops for re-glazing.
  2. Door panels, lift/roll and slide/fold: AWI Premium grade, produced from standard components. Stiles and rails shall be glued block construction with 1/8" minimum veneers. Joinery shall be dowelled construction, sized for drive fit and set in adhesive. All operating hardware shall be factory-installed. Glazed doors to incorporate interior removable glass stops for re-glazing.
  3. Door frames, swing: AWI Custom Grade, wood components to be solid stock.
  4. Door frames, lift/roll and slide/fold: AWI Custom Grade, wood components to be solid stock.
  5. Door screen, swing and lift/roll: AWI premium grade, glued block construction with 1/8" minimum veneers.

6. Machining for swing door hardware, if performed in factory, shall be predicated on the issuance of physical samples in addition to templates.

B. Permanent Joints and Facings: Bonded with water-resistant adhesive.

C. Wood Finish: Door leaves shipped unfinished must be sealed within one week of arrival at jobsite. Prefinished doors that are machined or fitted on site must have all milled surfaces resealed immediately.

1. Exterior: Note that all corners and edges of units receiving film-forming finishes (Sikkens, paint, etc.) are to be eased/radiused to promote finish adhesion and maintain proper film thickness.

- a. One (1) coat ICA #IM116 water-based impregnating agent, tinted per project requirements, one (1) coat #FA34 water-based bicomponent polyurethane sealer, two (2) coats #LA409 water-based monocomponent acrylic finish, 30 sheen.

2. Interior

- a. One (1) coat Sher-Wood® vinyl sealer T67F3 and two (2) coats Sher-Wood® Hi-Bild Catalyzed Lacquer T77F58.

## **PART 3 — EXECUTION**

### **3.1 EXAMINATION**

A. Examine conditions with installer present for compliance with all requirements. Inspect wall flashings, vapor retarders, water and weather barriers, and other built in components to ensure a weather tight installation.

B. Verify dimensions, tolerances, and method of attachment with other work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

A. General: Install windows per approved shop drawings, in proper relation to adjoining construction. Do not twist frames or force fit them into poorly prepared openings. Anchor windows as required to satisfy design requirements. See manufacturer's installation instructions and shop drawings.

B. Center window units in wall openings leaving a uniform interface caulking recess on all four sides. The manufacturer strongly suggests that sealant be selected for its adhesion compatibility with the specified exterior wood and adjacent wall materials. Consult the manufacturer for recommended sealant.

C. Level Units: Install shims at bearing locations, anchors, and latchpoint, so they are not dislodged by subsequent operations. Test sash operation and sash alignment before permanently anchoring units.

D. Anchorage: Install anchors through frame centerline beside shims. Anchor window units to wood blocking with wood screws and to metal framing with Tek screws; countersink anchor heads. All anchors shall be concealed by closed sash or with wood plugs.

E. Installation to conform to window manufacturer's requirements as indicated in the manufacturer's product manual.

### **3.3 FIELD QUALITY CONTROL**

A. Field Tests: Independent testing laboratory will perform air infiltration tests in accordance with ASTM E783, and water infiltration tests in accordance with AAMA 501.3.

1. Cost of initial testing to be born by General Contractor.



2. Costs for any remedial work and subsequent re-testing to be born by responsible party depending on nature of remedial work required.

### **3.4 CLEANING**

- A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, foreign materials and other unsightly marks.
- B. Clean exposed surfaces exercising care to avoid damage.
  1. Remove adhered matter and excess sealant materials.
  2. Replace glass which is broken, cracked, chipped, scratched, abraded or damaged in other ways.
- C. Wash glass on interior and exterior to remove paint, soil, prints and foreign matter. It is strongly advised that procedures and methods outlined in the following documents be strictly adhered to when cleaning Architectural glass:
  1. Glass Association of North America (GANA) Technical Bulletin 01-0300: *Glass Cleaning Procedure*
  2. GANA Technical Bulletin TD-02-0402: *Heat-treated Glass Surfaces Are Different*
  3. PPG Glass Technical Document TD-142: *Glass Cleaning Recommendations*

### **3.5 PROTECTION**

- A. Institute protective measures required throughout the construction period to ensure that both interior and exterior of wood doors will be without damage or deterioration, other than normal weathering.

**END OF SECTION**

**SECTION 08 17 43**  
**FRP/ ALUMINUM HYBRID DOORS & ALUMINUM FRAMES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. SL-20 Sandstone Texture FRP/ Aluminum Hybrid Door.
- B. SL-20 Sandstone Texture FRP/ Aluminum Hybrid Door installed in Retrofit Aluminum Framing.

**1.02 RELATED SECTIONS**

- A. Section 08 06 71 – Door Hardware Schedule.
- B. Section 08 06 80 – Glazing
- C. Section 08 10 00 – Doors and Frames.
- D. Section 08 12 16 – Aluminum Frames.
- E. Section 08 42 13 – Aluminum-Framed Entrances.
- F. Section 08 71 00 – Door Hardware.
- G. Section 08 91 26 – Door Louvers.

**1.03 REFERENCES**

- A. AAMA 1304 – Voluntary Specification for Forced Entry Resistance of Side-Hinged Door Systems.
- B. ASTM-B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- C. ASTM-B221 – Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- D. ASTM-C518 – Standard test Method for Steady-State Thermal Transmission Properties by Means of Heat Flow Meter Apparatus.
- E. ASTM-D256 – Standard Test Methods for Determining the Pendulum Impact Resistance of Plastics.
- F. ASTM-D570 – Standard Test Method for Water Absorption of Plastics.
- G. ASTM-D638 – Standard Test Method for Tensile Properties of Plastics.
- H. ASTM-D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- I. ASTM-D1621 – Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
- J. ASTM-D1622 – Standard Test Method for Apparent Density of Rigid Cellular Plastics.
- K. ASTM-D1623 – Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
- L. ASTM-D2126 – Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
- M. ASTM-D2583 – Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
- N. ASTM-D3029 – Test Methods for Impact Resistance of Flat Rigid Plastic Specimens by Means of a Tup (Falling Weight) (Withdrawn 1995) (Replaced by ASTM-D5420).
- O. ASTM-D5116 - Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/ Products.
- P. ASTM-D6670 – Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/ Products.
- Q. ASTM-E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- R. ASTM-E283 – Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- S. ASTM-E330 – Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- T. NFRC 100 – Procedure for Determining Fenestration Products U-Factors.
- U. NFRC 400 – Procedure for Determining Fenestration Products Air Leakage.
- V. TAS 201 – Impact Test Procedures.
- W. TAS 202 – Criteria for Testing Impact & Nonimpact Resistant Building Envelope Components Using Uniform Static Air Pressure.
- X. TAS 203 – Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.

**1.04 SUBMITTALS**

- A. Must comply with Section 01 33 00 – Submittal Procedures.
- B. Action Submittals/ Informational Submittals.
  - 1. Product Data.

- a. Submit manufacturer's product data sheets, catalog pages illustrating the products, description of materials, components, fabrication, finishes, installation instructions, and applicable test reports.
- 2. Shop Drawings.
  - a. Submit manufacturer's shop drawings, including elevations, sections, and details indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule, and finish.
- 3. Samples.
  - a. Submit manufacturer's door sample composed of door face sheet, core, framing and finish.
  - b. Submit manufacturer's sample of standard colors for door face and frame.
- 4. Testing and Evaluation Reports.
  - a. Submit testing reports and evaluations provided by manufacturer conducted by and accredited independent testing agency certifying doors and frames comply with specified performance requirements listed in Section 2.04.
- 5. Manufacturer Reports.
  - a. Manufacturer's Project References.
    - 1. Submit list of successfully completed projects including project name, location, name of architect, type, and quantity of doors manufactured.
- C. Closeout Submittals.
  - 1. Operation and Maintenance Manual.
    - a. Submit manufacturer's maintenance and cleaning instructions for doors and frames, including maintenance and operating instructions for hardware.
  - 2. Warranty Documentation.
    - a. Submit manufacturer's standard warranty.

## **1.05 QUALITY ASSURANCE**

- A. Manufacturer's Qualifications.
  - 1. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years concurrent successful experience.
  - 2. Door and frame components must be fabricated by same manufacturer.
  - 3. Evidence of a documented complaint resolution quality management system.

## **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery.
  - 1. Deliver materials to site in manufacturer's original, unopened, containers and packaging.
  - 2. Labels clearly identifying opening, door mark, and manufacturer.
- B. Storage.
  - 1. Store materials in a clean, dry area, indoors in accordance with manufacturer's instructions.
- C. Handling.
  - 1. Protect materials and finish from damage during handling and installation.

## **1.07 WARRANTY**

- A. Warrant doors, frames, and factory installed hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.
- B. Standard Period.
  - 1. Ten years starting on date of shipment.
- C. Limited lifetime
  - 1. Covers failure of corner joinery, core deterioration, and delamination or bubbling of door skin and corrosion of all-fiberglass products while the door is in its specified application in its original installation.
- D. Finish
  - 1. Kynar painted aluminum: 10 years.
  - 2. Painted SL-17, SL-18, SL-19, SL-20 face sheets: 5 years.
  - 3. Painted AF-100, AF-200, AF-150 frames, AF-250 frames: 3 years.
  - 4. Painted FR doors: 3 years.
  - 5. Stained SL-18 and SL-9 face sheets: 5 years.
  - 6. Anodized, aluminum: 10 years.
  - 7. Thresholds do not have a finish warranty.

## **PART 2 PRODUCTS**

### **2.01 FRP/ALUMINUM HYBRID DOORS**

- A. Manufacturer.

1. Special-Lite, Inc.
  - a. PO Box 6, Decatur, Michigan 49045.
  - b. Toll Free (800) 821-6531, Phone (269) 423-7068, Fax (800) 423-7610.
  - c. Web Site [www.special-lite.com](http://www.special-lite.com).
  - d. E-Mail [info@special-lite.com](mailto:info@special-lite.com).

## 2.02 DESCRIPTION

- A. Model.
  1. SL-20 Sandstone Texture FRP/ Aluminum Hybrid Door.
- B. Door Opening Size.
  1. As shown on the drawings.
- C. Construction.
  1. Door Thickness.
    - a. 1-3/4".
  2. Stiles & Rails.
    - a. Aluminum extrusions made from 6063 aluminum alloys with a minimum temper of T5.
    - b. Minimum 2-5/16" deep one-piece extrusion with have integral reglets to accept face sheet on both interior and exterior side of door which secure face sheet into place and permit flush appearance.
    - c. Screw or snap in place applied caps are not acceptable.
    - d. Top rails must have integral legs for interlocking continuous extruded aluminum flush cap.
    - e. Bottom rails must have integral legs for interlocking continuous weather bar with single nylon brush weather stripping or manually adjustable SL-301 door bottom with two nylon brush weather stripping.
    - f. Meeting stiles to include integral pocket to accept pile brush weather seal.
  3. Corners.
    - a. Mitered.
    - b. Secured with 3/8" diameter full-width steel tie rod through extruded splines top and bottom which are integral to standard tubular shaped rails.
    - c. 1-1/4" x 1-1/4" x 3/16" 6061 aluminum angle reinforcement at corner to give strong, flat surface for locking hex nut to bear on.
    - d. Weld, glue, or other methods of corner joinery are not acceptable.
  4. Core.
    - a. Poured-in-place polyurethane foam.
    - b. Laid in foam cores are not acceptable.
    - c. Foam Plastic Insulated Doors: IBC 2603.4.
      1. Foam plastic shall be separated from the interior of a building by an approved thermal barrier.
      2. Approved thermal barrier must meet the acceptance criteria of the Temperature Transmission Fire Test and Integrity Fire Test as stated in NFPA 275.
      3. IBC 2603.4.1.7 foam plastic insulation, having a flame spread index less than 75 and a smoke developed index of not more than 450 shall be permitted as a door core when the face is metal minimum 0.032" aluminum or 0.016" steel.
      4. Standard door assembly can be tested to show it meets these requirements without the use of thermal barrier. If no independent testing conducted all doors with foam plastic core must have a thermal barrier.
  5. Face Sheet.
    - a. Exterior
      1. 0.120" thick, Sandstone texture, through color FRP sheet.
      2. Optional painted finish consult manufacturer.
      3. Class C standard.
    - b. Interior
      1. 0.120" thick, Sandstone texture, through color FRP sheet.
      2. Optional painted finish consult manufacturer.
      3. Class C standard optional Class A available consult manufacturer.
    - c. Attachment of face sheet.
      1. Extruded stiles and rails to have integral reglets to accept face sheet on both interior and exterior side of door which secure face sheet into place and permit flush appearance.
      2. Use of glue to bond face sheet to core or extrusions is not acceptable.
  6. Cutouts.
    - a. Manufacture doors with cutouts for required vision lites, louvers, and panels.
  7. Hardware.
    - a. Pre-machine doors in accordance with templates from specified hardware manufacturers.
    - b. Surface mounted closures will be reinforced for but not prepped or installed at factory.

- c. Factory install door hardware.
- 8. Reinforcements.
  - a. Aluminum extrusions made from 6061 or 6063 aluminum alloys.
  - b. Sheet and plate to conform to ASTM-B209.
  - c. Alloy and temper to be selected by manufacturer for strength, corrosion resistance, and application of required finish, and control of color.
  - d. Bars and tubes to meet ASTM-B221.

## 2.03 FRAMING

### A. Framing

1. Aluminum Tube Framing with Applied Stops.
  - a. Model.
    1. SL-50.
  - b. Materials.
    1. See 2.05.A.
  - c. Perimeter Frame Members.
    1. Box type with 4 enclosed sides.
    2. Factory fabricated.
    3. Open-back framing is not acceptable.
  - d. Applied Door Stops.
    1. 5/8" x 1-1/4" or 5/8" x 1-3/4", 0.125" wall thickness, with screws and weather-stripping.
    2. Provide solid 1/2" aluminum bar behind door stop for closer shoe attachment.
    3. Pressure gasketing for weathering seal.
    4. Counterpunch fastener holes in door stop to preserve full-metal thickness under fastener head.
  - e. Caulking.
    1. Caulk joints before assembling frame members.
  - f. Frame Member to Member Connections.
    1. Secure joints with fasteners.
    2. Provide hairline butt joint appearance.
  - g. Hardware
    1. Pre-machine and reinforce frame members for hardware in accordance with manufacturer's standards and door hardware schedule.
    2. Surface mounted closures will be reinforced for but not prepped or installed at factory.
    3. Factory install door hardware.
  - h. Anchors:
    1. Anchors appropriate for wall conditions to anchor framing to wall materials.
    2. Door Jamb and Header Mounting Holes: Maximum of 24-inch centers.
    3. Secure head and sill members of transom, side lites, and similar conditions.
2. Capping.
  - a. Model.
    1. SL-70
  - b. Materials.
    1. See 2.05.A.
    2. Size as indicated on drawings.

## 2.04 PERFORMANCE

### A. Face Sheet.

1. Standard Interior and Exterior Class C 0.120" thick, Sandstone texture, through color FRP sheet.
  - a. Flexural Strength, ASTM-D790:  $27 \times 10^3$  psi.
  - b. Flexural Modulus, ASTM-D790:  $0.7 \times 10^6$  psi.
  - c. Tensile Strength, ASTM-D638:  $18 \times 10^3$  psi.
  - d. Tensile Modulus, ASTM-D638:  $1.0 \times 10^6$  psi.
  - e. Barcol Hardness, ASTM-D2583: 40.
  - f. Izod Impact, ASTM-D256: 7.0 ft-lb/in.
  - g. Gardner Impact Strength, ASTM-D5420: 30 in-lb.
  - h. Water Absorption, ASTM-D570: 0.16%/24hrs at 77°F.
  - i. Surface Burning, ASTM-E84: Flame Spread  $\leq 200$ , Smoke Developed  $\leq 450$ .
  - j. Chemical Resistance.
    1. Excellent Rating.
      - a. Acetic Acid, Concentrated.
      - b. Acetic Acid, 5%.
      - c. Bleach Solution.
      - d. Detergent Solution.

- e. Distilled Water.
  - f. Ethyl Acetate.
  - g. Formaldehyde.
  - h. Heptane.
  - i. Hydrochloric Acid, 10%.
  - j. Hydrogen Peroxide, 3%.
  - k. Isooctane.
  - l. Lactic Acid, 10%.
- k. USDA/FSIS Requirements.
  - 1. FRP face sheet with surfaseal is a finished outer surface material that is rigid; durable; non-toxic; non-corrosive; moisture resistant; a light, solid color such as white; easily inspected; smooth or an easily cleaned texture.
  - 2. FRP face sheet with surfaseal does not contain any known carcinogen, mutagen, or teratogen classified as hazardous substances; heavy metals or toxic substances; antimicrobials; pesticides or substances with pesticidal characteristics.
- B. Door Core.
  - 1. Density, ASTM-D1622:  $\leq 5.0$  pcf.
  - 2. Compressive Properties, ASTM-D1621: Compressive Strength  $\geq 60$  psi, Compressive Modulus  $\geq 1948$  psi.
  - 3. Tensile and Tensile Adhesion Properties, ASTM-D1623: Tensile Adhesion, 3" x 3" FRP Facers  $\geq 53$  psi, Tensile Adhesion, 1" x 1" Foam  $\geq 104$  psi.
  - 4. Thermal and Humid Aging, ASTM-D2126: Volume Change at 158 °F, 100% humidity, 14 days  $\leq 13\%$ .
  - 5. Thermal Conductivity, ASTM-C518, Thermal Resistance  $\geq 0.10$  m<sup>2</sup>K/W.
- C. Door Panel.
  - 1. Indoor Air Quality, ASTM-D5116, ASTM-D6607: GreenGuard, GreenGuard Gold.
- D. Door and Aluminum Tube Frame Assembly.
  - 1. Structural Performance, ASTM E-330.
    - a. Single or Pair of Doors, 6'4" x 7'2" overall size, single point latching.
      - 1.  $\pm 90$  psf design pressure, pass.

## 2.05 MATERIALS

- A. Aluminum Members.
  - 1. Aluminum extrusions made 6061 or 6063 aluminum alloys.
  - 2. Sheet and plate to conform to ASTM-B209.
  - 3. Alloy and temper to be selected by manufacturer for strength, corrosion resistance, and application of required finish, and control of color.
- B. Fasteners.
  - 1. All exposed fasteners will have a finish to match material being fastened.
  - 2. 410 stainless steel or other non-corrosive metal.
  - 3. Must be compatible with items being fastened.

## 2.06 FABRICATION

- A. Factory Assembly.
  - 1. Door and frame components from the same manufacturer.
  - 2. Required size for door and frame units, shall be as indicated on the drawings.
  - 3. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.
  - 4. All cut edges to be free of burs.
  - 5. Welding of doors or frames is not acceptable.
  - 6. Maintain continuity of line and accurate relation of planes and angles.
  - 7. Secure attachments and support at mechanical joints with hairline fit at contact surfaces.
- B. Shop Fabrication
  - 1. All shop fabrication to be completed in accordance with manufactures process work instructions.
  - 2. Quality control to be performed before leaving each department.

## 2.07 FINISHES

- A. Door.
  - 1. Aluminum.
    - a. Mill.
      - 1. AA-M10C22A21-Flash.
    - b. Anodizing.
      - 1. Class 1 Anodizing, minimum 0.7 mils thick.
        - a. Color.

1. Clear 215 R1, AA-M10C12C22A41.
2. FRP Face Sheets
  - a. Through color.
    1. Color.
      - a. Light Grey #5537.
- B. Frame
  1. Aluminum.
    - a. Mill.
      1. AA-M10C22A21-Flash.
    - b. Anodizing.
      1. Class 1 Anodizing, minimum 0.7 mils thick.
        - a. Color.
          1. Clear 215 R1, AA-M10C12C22A41.

## **2.08 ACCESSORIES**

- A. Hardware.
  1. Pre-machine doors in accordance with templates from specified hardware manufactures and hardware schedule.
  2. Factory install hardware.
  3. Hardware Schedule.
    - a. As specified in Section 08 71 00.
      1. Thresholds.
        - a. Aluminum threshold by Special-Lite.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine areas to receive doors.
- B. Notify architect of conditions that would adversely affect installation or subsequent use.
- C. Do not proceed with installation until unsatisfactory conditions are corrected.

### **3.02 PREPARATION**

- A. Ensure openings to receive frames are plumb, level, square, and in tolerance.

### **3.03 ERECTION**

- A. Install doors in accordance with manufacturer's instructions.
- B. Install doors plumb, level, square, true to line, and without warp or rack.
- C. Anchor frames securely in place.
- D. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by architect.
- E. Set thresholds in bed of mastic and back seal.
- F. Install exterior doors to be weathertight in closed position.
- G. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by architect.
- H. Remove and replace damaged components that cannot be successfully repaired as determined by architect.

### **3.04 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Services.
  1. Manufacturer's representative shall provide technical assistance and guidance for installation of doors.

### **3.05 ADJUSTING**

- A. Adjust doors, hinges, and locksets for smooth operation without binding.

### **3.06 CLEANING**

- A. Clean doors promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that would damage finish.

### **3.07 PROTECTION**

- A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

**END OF SECTION**

**SECTION 08 31 00  
ACCESS DOORS AND FRAMES**

**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Wall and ceiling access door and frame units.
- B. It is not intended that the Drawings or Specifications identify specific access door sizes or locations. Subcontractors whose work requires access panels in wall, floor, and ceiling assemblies shall thoroughly examine all Construction Documents and provide suitable access to all equipment, hardware, accessories and all other items that may require adjustment, observation or maintenance. Note: Access doors located in mechanical equipment or ductwork are provided as part of the work of Division 23 - HVAC.

**1.02 RELATED SECTIONS**

- A. Section 04 20 00 - Unit Masonry
- B. Section 09 21 16 - Gypsum Board Assemblies: Openings in partitions and ceilings.
- C. Section 09 90 00 Painting and Coating: Field paint finish.
- D. Division 22 - Plumbing
- E. Division 23 - HVAC
- F. Division 26 - Electrical

**1.03 SUBMITTALS**

- A. Product Data: Provide materials, construction, profiles, types, finishes, hardware, locking provisions, and details of adjoining work.
- B. Shop Drawings: Indicate exact position of all access door units.
- C. Project Schedule: Provide complete access door and frame schedule, including locations, sizes, latching or locking provisions, and other data pertinent to installation.

**1.04 QUALITY ASSURANCE**

- A. Source Limitations: Obtain access door(s) and frame(s) through one source from a single manufacturer.

**PART 2 PRODUCTS****2.01 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS**

- A. Manufacturers:
  - 1. Karp Associates, Inc.
  - 2. J.L. Industries, Inc.
  - 3. The Williams Brothers Corporation of America
- B. Access Doors: Factory fabricated door and frame units, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies that units are to be installed in.
  - 1. Material: Steel.
  - 2. Style: Exposed frame with door surface flush with frame surface.
    - a. In Gypsum Board: Use drywall bead type frame.
    - b. In Masonry: Provide adjustable metal masonry anchors.
  - 3. Door Style: Single thickness with rolled or turned in edges.
  - 4. Door Style for separating heated from non-heated areas: Double wall with integral non-combustible insulation filler.
  - 5. Door Style for Fire-rated locations: Double wall with integral non-combustible insulation



- filler.
6. Frames: 16 gage, 0.0598 inch, minimum.
  7. Single Thickness Steel Door Panels: 0.070 inch, minimum.
  8. Double-Skinned Hollow Steel Door Panels: 16 gage, 0.059 inch, minimum, on both sides and each edge.
  9. Insulation: Non-combustible mineral or glass fiber.
  10. Units in Fire Rated Assemblies: Fire rating as required by applicable code for the fire rated assembly that access doors are being installed.
    - a. Provide products listed and labeled by UL or ITS (Warnock Hersey) as suitable for the purpose specified and indicated (labeled for horizontal or vertical installation).
  11. Finish: Factory prime painted for field finish painting.
  12. Size: As required for each condition, minimum size 8" x 8".
  13. Hardware:
    - a. Hardware for Fire Rated Units: As required for listing.
    - b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
    - c. Latch/Lock: Cylinder lock operated cam latch, two keys for each unit.
      - 1) Mortise cylinder and core specified in Section 08 71 00.
    - d. Inside Latch Release: For all doors intended to allow a person to fully pass through, provide Mechanism that allows the panel to be opened from the inside without the use of a tool or key
    - e. Gasketing: For all doors that separate heated and unheated space. Extruded neoprene, around the perimeter of the door panel.
    - f. Horizontal Applications: Equip with restraints to prevent doors from falling open or closed upon release. All doors greater in size than 300 square inches and installed horizontally shall be provided with the following sign in 1/2" high red letters adjacent to the door lock: "Caution: Door will drop upon lock release".

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that rough openings for door and frame are correctly sized and located.
- B. Door locations that may physically or visually conflict with adjacent construction or building features shall be brought to the attention of the Architect prior to 'roughing-in'. Doors installed in locations objectionable to the Architect shall be removed, patched, and relocated at no additional cost to the Owner.

### **3.02 INSTALLATION**

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings. Secure rigidly in place.
- C. Position units to provide convenient access to the concealed work requiring access.
- D. Adjust hardware and panels after installation for proper operation.
- E. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.
- F. Door lock keys shall be labeled and turned over to the Owner per Project Close-out requirements.

## **END OF SECTION**

**SECTION 08 41 13**  
**ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**

**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.02 SUMMARY**

- A. Section Includes:
  - 1. Exterior entrance and storefront framing.
  - 2. Exterior manual swing doors
  - 3. Break metal in conjunction with frames.
  - 4. Sealant at interior and exterior perimeter of storefront.
- B. Related Sections:
  - 1. 079200 "Joint Sealants" for installation of joint sealants installed with aluminum-framed systems and floor sealants to the extent not specified in this Section.
  - 2. 087000 "Door Hardware" for door hardware requirements to the extent not specified in this section.
  - 3. 088000 "Glazing" for glazing requirements to the extent not specified in this Section.

**1.03 DEFINITIONS**

- A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufacturers Association (AAMA) – AAMA Glossary (AAMA AG).

**1.04 PERFORMANCE REQUIREMENTS**

- A. General Performance: Aluminum-framed entrance doors shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
  - 1. Wind loads: Provide entrance system; include anchorage, capable of withstanding wind load design pressures of 30 lbs./sq. ft. The design pressures are based on the International Building Code; 2009 Edition.
  - 2. Air Infiltration: For single acting offset pivot or butt hung entrances in the closed and locked position, the test specimen shall be tested in accordance with ASTM E 283 at a pressure differential of 1.57 psf (75 Pa) for pairs of doors. A single 3'0" x 7'0" (915 mm x 2134 mm) entrance door and frame shall not exceed 1.0 cfm/ft<sup>2</sup>. A pair of 6'0" x 7'0" (1830 mm x 2134 mm) entrance doors and frame shall not exceed 1.0 cfm per square foot.
  - 3. Uniform Load: A static air design load of 20 psf (958 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 for typical application or L/180 for Small-Missile and Large-Missile impact, of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.
  - 4. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than:
    - a. Insulated Glass – 0.43 (low-e) per AAMA 507.
  - 5. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than:
    - a. Insulated Glass – 57<sub>frame</sub> and 71<sub>glass</sub> (low-e).
  - 6. Condensation Resistance (I): When tested to CSA A440, the condensation resistance factor shall not be less than:
    - a. Insulated Glass – 48<sub>frame</sub> and 69<sub>glass</sub> (low-e).
  - 7. Sound Transmission Class (STC) and Outdoor-Indoor Transmission Class (OITC): When tested in accordance with ASTM E 90, the STC and OITC ratings shall not be less than:
    - a. 32 (STC) and 28 (OITC).

## **1.05 SUBMITTALS**

- A. Product Data: Include construction details, material descriptions, and fabrication methods, dimensions of individual components and profiles, hardware, finishes, and installation instructions for each type of aluminum-framed entrance door indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, hardware, and attachments to other work, operational clearances and installation details.
  - 1. Include details of provisions for system expansion and constraction and for drainage of moisture in the system to the exterior.
  - 2. For entrance doors, included hardware schedule and indicate operating hardware types, funcitons, quantities, and locations
  - 3. Indicate fastener layout and size for transferring loads back to supporting structure.
- C. Samples for Initial Selection: For units with factory-applied color finishes. Manufacturer's color chartsconsisteing of strips of cured sealants showing the fullrange of colors available for each product exposed to view, including samples of hardware, sealants and accessories.
- D. Samples for Verification: For aluminum-framed door and components required.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type of aluminum-framed entrance doors.
- F. Fabrication Sample: Corner sample consisting of a door stile and rail, of full-size components and showing details of the following:
  - 1. Joinery, including welds.
  - 2. Glazing.
- G. Warranties: Samples of special warranties.

## **1.06 QUALITY ASSURANCE**

- A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.
- B. Manufacturer Qualifications: A manufacturer capable of fabricating thermally broken aluminum-framed entrance doors and storefronts that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports and calculations.
- C. Source Limitations: Obtain thermally broken aluminum-framed door through one source from a single manufacturer.
- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum-framed glass entrance doors and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements". Do not modify size and dimensional requirements.
  - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockup for type(s) of swing entrance door(s) indicated, in location(s) shown on Drawings.
- F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01.

### **1.07 PROJECT CONDITIONS**

- A. Field Measurements: Verify actual dimensions of thermally broken aluminum-framed door openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

### **1.08 WARRANTY**

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.
  - 1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

### **1.09 PROJECT CONDITIONS**

- A. Field Measurements: Verify actual locations of structural support for aluminum-frames systems by field measurements before fabrication and indicate measurements on Shop Drawings.
  - 1. Coordinate rough opening, masonry opening, and wood blocking requirements.

### **1.10 MAINTENANCE SERVICE**

- A. Maintenance Tools and Instrutions: Furnish a complete sesst of specialized tools and meatenance instruction as needed for Owner's continued adjustment, maintenance, and removal of replacement of entrance door hardware.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Basis-of-Design Product:
  - 1. Kawneer Company Inc.:
    - a. Exterior Storefront and Entrances: 451T frame.
  - 2. Or a comparable product by one of the following manufacturers:
    - a. EFCO Corporation
    - b. TRACO
    - c. Tubelite

### **2.02 MATERIALS**

- A. Aluminum Extrusions: Alloy and temper recommended by aluminum-framed door manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.090" wall thickness at any location for the main frame and door leaf members.
- B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum-framed door members, trim hardware, anchors, and other components.
- C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- E. Slide-In-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
  - 1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semi-rigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.

### **2.03 STOREFRONT FRAMING SYSTEM**

- A. Storefront Entrance Framing:
  - 1. Trifab™ 451T
  - 2. Thermally Broken entrance framing a 1/4" (6.4 mm) separation consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections.

- a. Thermal Break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.
- B. Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposed shall be stainless steel.
- D. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
- E. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- F. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after storefront installation.

## 2.04 GLAZING

- A. Glazing: As specified in Division 08 Section "Glazing".
- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.
- C. Spacers and Setting Blocks: Manufacturer's standard permanent, nonmigrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.

## 2.05 HARDWARE

- A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum-framed entrance doors. Provide specified manufacturer's without substitution.
  - 1. Opening-Force Requirements:
    - a. Egress Doors: Not more than 15lbf to release the latch and not more than 30 lbf to set the door in motion.
- B. Ball-Bearing Hinges:
  - 1. Material: Stainless steel, including pin.
  - 2. Provide nonremovable pins (NRP) at hinges exposed to outside of exterior doors and to nonsecured side of interior doors.
  - 3. Quantities:
    - a. For doors with height up to 87 inches, provide 3 hinges per leaf.
    - b. For doors with heights greater than 87 and up to 120 inches, provide 4 hinges per leaf.
- C. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to the authorities having jurisdiction, for panic protection.
- D. Cylinders: Manufacturer's standard. Coordinate keying and installation with Owner.
- E. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to meet field conditions and requirements for opening force.

- F. Weather Stripping: Manufacturer's standard replaceable components.
  - 1. Compression Type: Made of ASTM D 2000, molded neoprene, of ASTM D2287, molded PVC. Provide at head and jamb of all exterior doors.
- G. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- H. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of ½". Coordinate cutouts for operating hardware with anchors and jamb clips.
  - 1. Material: Aluminum, mill finish.
- I. Balance of Hardware: See Division 08 Section "Door Hardware".

## **2.06 ACCESSORY MATERIALS**

- A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 "Joint Sealants".
- B. Bituminous Paint: cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil thickness per coat.

## **2.07 FABRICATION**

- A. Fabricate thermally broken aluminum-framed entrance doors in sizes indicated. Include a complete system for assembling components and anchoring doors.
- B. Fabricate thermally broken aluminum-framed doors that are reglazable without dismantling perimeter framing.
  - 1. Door corner construction shall consist of mechanical clip fastening, SIGMA deep penetration plug welds and 1" (24 mm) long fillet welds inside and outside of all four corners. Glazing stops shall be hook-in type with EPDM glazing gaskets reinforced with non-stretchable cord.
  - 2. Accurately fit and secure joints and corners. Make joints hairline in appearance.
  - 3. Prepare components with internal reinforcement for door hardware
  - 4. Arrange fasteners and attachments to conceal from view.
- C. Weather-stripping: Provide weather-stripping locked into extruded grooves in door panels or frames as indicated on manufacturer's drawings and details.

## **2.08 ALUMINUM FINISHES**

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designation prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. High Performances Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated installation.

1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
2. Confirm that wood blocking, where used, has been sufficiently fastened to transfer storefront loads back to structure.
3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 INSTALLATION**

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing thermally broken aluminum-framed entrance doors, hardware, accessories, and other components.
- B. Install thermally broken aluminum-framed entrance doors level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- C. Set sill threshold in bed of sealant, as indicated, for weather tight construction.
- D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

### **3.03 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Services: Upon Owner's written request, provide periodic site visit by manufacturer's field service representative.

### **3.04 ERECTION TOLERANCES**

- A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
  1. Location and Plane: Limit variation from true location and plane to 1/8" in 12 feet; 1/4 inch over total length.
  2. Alignment:
    - a. Where surfaces abut in line, limit offset from true alignment to 1/16" inch.
    - b. Where surfaces meet at corners, limit offset from true alignment to 1/32" inch.

### **3.05 ADJUSTING, CLEANING, AND PROTECTION**

- A. Clean aluminum surfaces immediately after installing aluminum-framed door and storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- D. Protection: Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures entrances and storefront systems are without damage or deterioration at time of Substantial Completion.

**END OF SECTION**

**SECTION 08 45 20**  
**SURFACE MOUNTED POLYCARBONATE SKYLIGHT SYSTEM**

**PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Aluminum framed canopy system, glazed with UV resistant cellular polycarbonate glazing panels.
- B. All anchors, brackets, and hardware attachments necessary to complete the specified assembly.
- C. All flashings up to adjoining work are also required as part of the system and shall be included, unless specifically noted as being supplied by others.

**1.2 RELATED SECTIONS**

- A. Division 06 Section "Finish Carpentry & Architectural Woodwork for wood trellis.
- B. Division 07 Section "Sheet Metal Flashing and Trim" for flashings

**1.3 SYSTEM DESCRIPTION**

- A. Aluminum canopy frame glazed with flat translucent cellular polycarbonate panels.
- B. Design Requirements:
  - 1. Support structure, constructed of materials of adequate load bearing capacity and to maintain visual design concepts, and for attachment to and support of the specified system, supplied by other trades.
  - 2. Glazing panels, extruded and supplied in flat sheet sizes as needed to accommodate system framing.
  - 3. Whenever possible, fasteners shall be concealed.
  - 4. System shall be dry glazed.
  - 5. Air permeable tape shall be applied to the top and bottom edges of the glazing panels.
  - 6. Unrestricted thermal movement of the glazing panels shall be allowed to occur within the framing system without compromising its weathertightness.
  - 7. The rabbet depth of all framing members shall, at a minimum, be based on a  $\frac{3}{4}$ " (.75") engagement of the glazing panel, plus  $\frac{1}{8}$ " (.125") cutting tolerance, plus  $.005 \times$  the glazing dimension (in inches) that affects that rabbet. For example, a glazing panel that is 100" long will require a minimum rabbet depth of  $.75" + .125" + (.005 \times 100") = 1.375"$ .
- C. Performance Requirements:
  - 1. Air Infiltration: ASTM E-283: Air infiltration shall not exceed 0.03 cubic feet per minute per square foot of panel area when tested at pressure of 12.0 psf.
  - 2. Water Penetration: None when tested at a pressure of 12 psf in accordance with ASTM E-331.
  - 3. Structural Performance: The system shall be capable of supporting the design loading required by local building code.

Testing by a certified independent testing laboratory, in accordance with ASTM E-330, shall evidence this. In addition, the deflection of all framing members oriented normal to the glazing plane shall not exceed  $L/175$ .



**1.4 SUBMITTALS**

- A. Submit three (3) each of the following to the Architect for review at the same time the Shop Drawings are submitted:
  - 1. Each aluminum frame section – 6" long.
  - 2. Samples of aluminum illustrating the specified finish.
  - 3. Glazing gaskets – 6" long – each type.
  - 4. Samples of glazing, each minimum 6" x 6", in specified color.
  - 5. Test reports.
  - 6. Product Data.
- B. Shop Drawings:
  - 1. Shall include plans and/or elevations and details of the system and its installation. Flashings, sealants, and anchorage shall be clearly indicated.
  - 2. Shall note gauges of brake metal, the finish(es) on the framing members, and any other information necessary to properly describe and install the system.

**1.5 QUALITY ASSURANCE**

- A. Materials and Products shall be manufactured by a company continuously and regularly employed in the manufacture of glazing systems using cellular polycarbonate panel systems for a period of at least ten (10) years. Manufacturers shall provide a list of at least ten (10) projects having been in place a minimum of five (5) years.
- B. Erection shall be by the manufacturer or an installer experienced in erection of systems of the type specified.
- C. The manufacturer shall be responsible for the configuration and fabrication of the complete system, and will ensure that it fully meets all requirements of this specification.
- D. Approved Manufacturers: All manufacturers acceptable for use on this project under this section must be approved prior to bid. Manufacturers must submit evidence of compliance with all performance criteria specified herein. Any exceptions taken to this specification must be noted on the approval request. If approval is granted and non-compliance is subsequently discovered, the previously given approval will be invalidated and use of the product on the project will be disallowed. Requests for approval, with all test reports, submittals, and samples as specified herein, must be received no less than twelve (12) days prior to bid date. A list of all approved manufacturers and products will be issued by addendum. No verbal approvals will be given.

**1.6 DELIVERY, STORAGE AND HANDLING**

- A. Deliver materials to the jobsite in the manufacturer's original and unopened containers and bearing labels as to type of material and manufacturer's name. Delivered materials shall be identical to approved samples.
- B. Store materials under cover in a dry, clean location, off the ground. Remove from the jobsite any materials that are damaged or otherwise not suitable for installation and replace with acceptable materials.
- C. Protective coverings containing PVC shall not be used in contact with polycarbonate.

**1.7 WARRANTY**

- A. The Manufacturer shall provide a written warranty certifying that if, within one (1) year from the shipment date of the system, the system experiences water leakage owing to defects in fabrication

or materials, the Manufacturer will, in a timely manner, furnish (only) new components to replace all of those found to be defective.

- B. The above warranty does not apply in the cases of structural movement of the building(s), negative air pressure inside the building(s), acts of God, alteration or abuse of the products, or unreasonable use.
- C. The liability of the Warrantor shall be limited to the above and shall not include incidental or consequential damages of any kind.
- D. The polycarbonate or glass glazing materials or any other materials or system (example... finishes on metals) furnished and warranted by others, shall be covered by only those warranties.
- E. These additional written warranties will also be provided:
  - 1. The polycarbonate manufacturer's ten (10) year prorated warranty against defective materials, color change and damage.
  - 2. The framing finish applicator's warranty as specified below :
    - a. Anodized Finish: One (1) year from date of application against chalking, fading, cracking, crazing, and blistering.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURER AND PRODUCT**

- A. EXTECH/Exterior Technologies, Inc., 200 Bridge Street, Pittsburgh, PA 15223; Phone (800) 500-8083, Fax (800) 500-8012, website [www.extechinc.com](http://www.extechinc.com) or approved equal.
- B. Series #3300 Surface Mounted Polycarbonate Canopy System.

### **2.2 MATERIALS**

- A. Framing:
  - 1. Shall be extruded aluminum of 6063-T5, 6005-T5 or 6105-T5 alloy and temper. All sections shall be formed true to detail and free from defects impairing appearance, strength or durability.
  - 2. Thermally-improved intermediate mullions shall be integrated with non-thermally broken perimeter aluminum framing members.
- B. Glazing Gaskets:
  - 1. Shall be elastomeric, having low friction surfaces where they contact the glazing.
  - 2. Shall be tested for chemical compatibility with the glazing, and test reports evidencing same shall be presented to the Architect.
- C. Fasteners:
  - 1. Where exposed, shall be stainless steel, 300 Series, with stainless steel backed neoprene washers.
  - 2. Concealed fasteners they may be stainless or zinc-plated steel in accordance with ASTM Specifications A165-55 or A164-55.
  - 3. Bolts, anchors and other fastening devices shall be as required for the strength of the connections and shall be suitable for conditions encountered. Washers shall be of the same metals as fasteners.

## D. Flashing:

1. Minimum 0.040 thick Aluminum anodized finish: 5005-H34.
2. Factory formed to required profile(s) in 10-ft lengths, whenever practical, to allow for field trimming to suit as-built conditions.
3. The finish on this metal shall match as closely as possible that which is on the extruded aluminum framing members.

## E. Glazing:

## 1. Polycarbonate

## A. Extruded Polycarbonate

- a. The extruded panels shall be uniform in color with an integral extruded multi-cell core. The panel's exterior skins shall be interconnected and spaced apart by continuous perpendicular supporting ribs. The space between the two exterior skins, in a cross section, shall be divided by multiple parallel intermediate walls.
- b. Extruded panels shall consist of a polycarbonate resin with permanent, co-extruded, ultraviolet (UV) protective layers on both sides of the panels. These protective layers shall be co-extruded by the manufacturer during the original extrusion of the panel and shall be a permanent part of both the interior and exterior of the panels. Post-applied coating or films of dissimilar materials are unacceptable.
- c. Panels shall be 6mm (1/4") - [25mm (1")] thick based on span. Coordinate with architect and structural engineer..
- d. Panel width shall vary to suite needs of the project.
- e. Color: To be selected by architect from manufacturer's full range.

## F. Attachment:

- a. System shall be fastened to substrate with fasteners that are designed and installed by the installer.
- b. Fasteners to penetrate through one-piece perimeter extrusions, and through base extrusions of intermediate mullions.
- c. Any shims or appurtenances required to facilitate system mounting and isolation shall be provided and installed by the installer.

## G. Flammability:

- a. The panel shall have a CC1 fire rating classification when tested in accordance with ASTM D-635 or equivalent.
- b. The panel shall have a Class A flame spread and smoke development rating when tested in accordance with ASTM E-84.

**2.3 FABRICATION AND WORKMANSHIP**

- A. Construct canopy using extruded aluminum members.

- B. Carefully and accurately design, fabricate and assemble work with proper provision for thermal contraction and expansion. Work shall conform to profiles and sections noted on the shop drawings. Work shall be assembled with joints in a neat and finished manner.
- C. All framing members shall be factory fabricated and assembled to the greatest degree possible, including the following:
  - 1. Cutting members to length.
  - 2. Installation of glazing gaskets, to be glued within extruded gasket tracks.
  - 3. Drilling straight and countersunk mounting holes, fastener access holes, and weep holes.
  - 4. Fabricating miter joints with concealed joint reinforcements and joint gaskets.
  - 5. Installation of non-metallic thermal isolation spacers.
  - 6. Removal of extrusion portions to accommodate tight over-lapping joinery and connections, including coped ends, mid-span notches, etc.
  - 7. Fabrication and installation of splice plates at jointed connections.

## **2.4 FINISHES**

- A. Exposed surfaces of the aluminum framing members shall be finished as follows:
  - 1. Anodized Coatings:
    - a. Architectural Class I Color Anodized type AA-M10C22A44 electrolytically deposited complying with AAMA 611, 0.7 mil thick minimum

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION**

- A. All submitted opening sizes, dimensions and tolerances are to be field verified by the installer unless otherwise stipulated.
- B. Installer to examine site conditions to verify readiness. Notify general contractor or owner about any defects requiring correction, including but not limited to improperly sloping sill substrates and uneven planar substrates. Do not work until conditions are satisfactory.

### **3.2 INSTALLATION**

- A. Install components in strict accordance with manufacturer's instructions and approved shop drawings. Use proper fasteners and hardware for material attachments as specified.
- B. Use methods of attachment to structure which include provisions for thermal movement.
- C. Glazing shall be installed in accordance with panel and system manufacturer's guidelines.
- D. Remove all protective coverings on polycarbonate panels during or immediately after installation.
- E. Installation shall be performed by a company with ten (10) years continuous experience in commercial construction.
- F. Protect contact points between unprotected dissimilar metals (except stainless steel) using continuous separators of FRP, PVC tape (or approved equal)

### **3.3 CLEANING AND PROTECTION**

- A. During installation, protect exposed surfaces against accumulation of paint, caulking, disfiguration and damage.
- B. Interior glazing surfaces shall be cleaned as the panels are being installed. The exterior shall be cleaned as each phase of the work is completed.
- C. Follow panel manufacturer instructions when cleaning exposed panel surfaces. Clean polycarbonate and frame at time of installation.
- D. Follow panel manufacturer's guidelines when removing foreign substances from panel surfaces. Use only solvents that are deemed acceptable for use.
- E. Before final acceptance, repair and/or replace any defective materials or work.

**END OF SECTION**

**SECTION 08 54 30  
TRIPLE GLAZED uPVC WINDOWS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Steel Reinforced uPVC Windows.
- B. Perimeter sealant.

**1.02 RELATED REQUIREMENTS**

- A. Division 05 Section "Metal Fabrications" for sheet metal flashing
- B. Division 07 Section "Joint Sealants" for perimeter sealant and back-up materials.
- C. Division 08 Section "Glazing"

**1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-installation Meeting: Conduct a pre-installation meeting at least 2 weeks before starting work of this Section.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data:
  - 1. Submit window product data including materials, describe components within assembly, anchorage and fasteners, glazing and infill, internal drainage details.
- C. Shop Drawings: Indicate window dimensions, framed opening requirements and tolerances.
- D. Shop Drawings: Provide details of proposed weather sealant joints indicating dimensions, materials, bite, thicknesses, profile, and support framing.
- E. Samples: Submit full window corner profile illustrating finished PVC frame, glazing and hardware.
- F. Field Quality Control Submittals: Report of field testing for water leakage.
- G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer and Installer Qualifications: Company specializing in manufacturing triple glazed, steel reinforced uPVC windows.
- B. Fabricator / Installer: Company specializing in the work of this Section with a minimum of ten years of documented experience and approved by the manufacturer.

**1.06 MOCK-UP AND SAMPLE INSTALLATIONS**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-ups.
- B. Sample Installation: Upon the commencement of the window installation, provide a 1 full window sample installation including all components occurring on the Project. Assemble to illustrate component assembly including glazing materials, attachments, anchors and perimeter sealant.
  - 1. Sample installation shall demonstrate actual detailing and workmanship.
  - 2. No work shall progress until the Architect has reviewed the sample installation. Installation shall be revised as necessary to secure the Architect's acceptance and shall then become

the standard of comparison for all similar units.

- C. Locate where directed by Owner and Architect. Accepted sample installation may remain as part of the Work.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished window PVC and glass surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to finish when exposed to sunlight or weather.

#### **1.08 FIELD CONDITIONS**

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

#### **1.09 WARRANTY**

- A. See Section 01 78 00 - Project Close-out, for additional warranty requirements.
- B. Provide (10) ten year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- C. Provide (20) twenty year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Basis of Design: Workhorse Classic by Mavrik, Inc.: 40 Grove Street, Site 201 Middletown, NY 10940 (347) 352-2495.

#### **2.02 STEEL REINFORCED uPVC WINDOW**

- A. Window: Factory fabricated, factory finished uPVC windows reinforced with steel.
  - 1. Operation: Tilt/Turn
  - 2. Glazing System: Triple, Standard
  - 3. Insect Screen: Standard
  - 4. Hinges: Concealed
  - 5. Color: Deep Black
  - 6. Accessories: Turn opening limiter
  - 7. Perimeter Clearance: Minimize space between window and adjacent construction while allowing expected movement.

#### **2.03 PERFORMANCE REQUIREMENTS**

- A. Thermal Performance Requirements:
  - 1. U-value at Frame: 0.21 Btu/(hr sq ft deg F), maximum.
  - 2. U-value at Glazing: 0.11 Btu/(hr sq ft deg F), maximum.

#### **2.04 MATERIALS**

- A. uPVC (un-plasticized poly vinyl chloride): ASTM D4726-15.
- B. Fasteners: Stainless steel; manufacturer's standard.
- C. Exposed Flashings: 0.032 inch thick aluminum sheet; finish to match window.
- D. Perimeter Sealant: Silicone as specified in Section 07 90 05.

### **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify dimensions, tolerances, and method of attachment with other related work.
- B. Verify that window openings and adjoining air and vapor seal materials are ready to receive work of this section.
- C. Verify that anchorage devices have been properly installed and located.

### **3.02 INSTALLATION**

- A. Window Installation:
  - 1. Install windows in accordance with manufacturer's instructions.
  - 2. Provide attachments and shims to permanently fasten system to building structure.
  - 3. Align window plumb and level. Maintain assembly dimensional tolerances, aligning with adjacent work.
  - 4. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
  - 5. Coordinate attachment and seal of perimeter air and vapor barrier materials. See Section 07 25 00.
  - 6. Install foamed-in insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- B. Install perimeter sealant in accordance with Section 07 90 05.
- C. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

### **3.03 FIELD QUALITY CONTROL**

- A. Provide the services of the manufacturer's field representative to observe installation and make report.
- B. See Section 01 40 00 - Quality Requirements, for general requirements for testing and inspection.

### **3.04 ADJUSTING**

- A. Adjust all tilt/turn functions for smooth operation.

### **3.05 CLEANING**

- A. Remove protective material from pre-finished uPVC surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

### **3.06 PROTECTION**

- A. Protect installed products from damage until Date of Substantial Completion.

**END OF SECTION**



**SECTION 08 71 00  
DOOR HARDWARE****PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.02 SUMMARY**

- A. This Section includes the following:
  - 1. Commercial door hardware for the following:
    - a. Swinging doors.

**1.03 SUBMITTALS**

- A. General: Submit in accordance with Division 01 Section "General Requirements."
  - 1. Submittals for Sections 081113 and 087100 shall be made concurrently.
- B. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- C. 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.
    - a. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.
  - 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 each 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. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
      - 1) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.
    - i. Provide hardware for every door in the project, except as indicated, so that each door functions correctly for its intended use. Where a door is not included in the Door Hardware Schedule at end of Part 3, provide hardware scheduled for similar type opening and review with Architect.
  - 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, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

- D. Keying Schedule: Meet directly with the Owner to review hardware function and keying requirements before ordering hardware. Prepare keying schedule by or under the supervision of supplier, detailing Owner's final keying instructions for locks.

#### **1.04 QUALITY ASSURANCE**

- A. Installer Qualifications: An experienced installer who has completed 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.
- B. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
  - 1. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- C. Architectural Hardware Consultant Qualifications: A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
- D. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
- E. Regulatory Requirements: Comply with provisions of the following:
  - 1. Comply with all applicable codes, complying with most stringent requirements if a conflict exists between codes. Comply with Americans with Disabilities Act (ADA), as follows:
    - a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
    - b. Door Closers: Comply with the following maximum opening-force requirements indicated:
      - 1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
    - c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.
  - 2. NFPA 101: Comply with the following for means of egress doors:
    - a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
    - b. Door Closers: Not more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.
- F. Keying Conference: Conduct conference directly with the Owner. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
  - 1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
  - 2. Requirements for key control system.
  - 3. Address for delivery of keys.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Meetings." Review methods and procedures related to door hardware including, but not limited to, the following:
  - 1. Review sequence of operation for each type of electrified door hardware.

2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review required testing, inspecting, and certifying procedures.
4. Review proper installation procedures for locksets, exit devices and closers with Installer and Hardware Supplier.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- 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 keys to Owner by registered mail or overnight package service.

#### **1.06 COORDINATION**

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

#### **1.07 WARRANTY**

- A. General Warranty: 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. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
  1. Structural failures including excessive deflection, cracking, or breakage.
  2. Faulty operation of operators.
  3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- C. Warranty Period for Manual Closers: 10 years from date of Substantial Completion.

### **PART 2 - PRODUCTS**

#### **2.01 SCHEDULED DOOR HARDWARE**

- A. General: Provide door hardware for each door to comply with requirements in this Section, and the Door Hardware Schedule at the end of Part 3.
  1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturer's products.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Schedule at the end of Part 3.

#### **2.02 HINGES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Hinges:
    - a. Hager Companies.
    - b. McKinney Products Company; Div. of ESSEX Industries, Inc.
    - c. Stanley Commercial Hardware; Div. of The Stanley Works.

- B. Standards: Comply with the following:
1. Butts and Hinges: BHMA A156.1.
  2. Template Hinge Dimensions: BHMA A156.7.
- C. Quantity: Provide the following, unless otherwise indicated:
1. Two Hinges: For doors with heights up to 60 inches.
  2. Three Hinges: For doors with heights 61 to 90 inches.
  3. Four Hinges: For doors with heights 91 to 120 inches.
  4. 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.
- D. Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

Maximum Door Size (inches)	Hinge Height (inches)	Metal Thickness (inches)	
		Standard Weight	Heavy Weight
40 and under by 1-3/4	4-1/2	0.134	0.180
Over 40 by 1-3/4	5	0.146	0.190

- E. Hinge Weight: Unless otherwise indicated, provide the following:
1. Doors with Closers: Ball-bearing hinges.
  2. Interior Doors: Standard-weight hinges, ball-bearings unless specified otherwise.
- F. Hinge Base Metal: Unless otherwise indicated, provide the following:
1. Interior Hinges: Steel or bronze, with steel pin.
- G. Hinge Options: Comply with the following:
1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
    - a. Outswinging interior doors with locks.
  2. Corners: Square.
- H. Fasteners: Comply with the following:
1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
  2. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
  3. Screws: Phillips flat-head screws; machine screws (drilled and tapped holes) for metal doors. Finish screw heads to match surface of hinges.

### 2.03 LOCKS AND LATCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Mortise Locks: Stamped steel case with steel or brass parts; BHMA Grade 1; Series 1000.
1. Best Access Systems; Div. of Stanley Security Solutions, Inc.; 45H Series, Lever Design 15H.
- C. Lock Trim: Comply with the following:
1. Lever: Forged or Cast.
  2. scutcheon (Rose): Wrought, forged, or cast.
- D. Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:
1. Minimum 3/4-inch latchbolt throw.

2. Deadbolts: Minimum 1-inch bolt throw.

- E. Backset: 2-3/4 inches, unless otherwise indicated.

## **2.04 DOOR BOLTS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Flush Bolts:
    - a. Door Controls International.
    - b. Glynn-Johnson; an Ingersoll-Rand Company.
    - c. Ives: H. B. Ives.
    - d. Rixson-Firemark, Inc.; Div. of Yale Security Inc.
    - e. Rockwood Manufacturing Company.
- B. Standards: Comply with the following:
  1. Automatic and Self-Latching Flush Bolts: BHMA A156.3.
- C. Flush Bolts: BHMA Grade 1, designed for mortising into door edge.
- D. Bolt Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:
  1. Mortise Flush Bolts: Minimum 3/4-inch throw.
- E. Strikes: Provide matching strikes for heads of doors. Provide dust proof strikes at all floor locations.

## **2.05 CYLINDERS AND KEYING**

- A. Available Manufacturers:
  1. Cylinders: ASSA Twin 6000 or similar. Field verify existing cylinders and review with Owner.
- B. Keying System: Prepare keying schedule with the Owner.
  - 1.
- C. Keys: Provide nickel-silver keys complying with the following:
  1. Stamping: Permanently inscribe each key with a visual key control number.
  2. Quantity: In addition to one extra blank key for each lock, provide the following:
    - a. Cylinder Change Keys: Three for each cylinder keyed differently; Six for each set keyed alike; Four for sets where only two cylinders are keyed alike.

## **2.06 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.

## **2.07 ACCESSORIES FOR PAIRS OF DOORS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Coordinators:
    - a. Door Controls International.
    - b. Glynn-Johnson; an Ingersoll-Rand Company.
    - c. Hager Companies.
    - d. Rockwood Manufacturing Company.
- B. Standards: Comply with the following:
  1. Coordinators: BHMA A156.3, Type #21
    - a. Shall be provided at pairs of equipped with overlapping astragals or where improper closing sequence would interfere with proper operating of doors.

- b. Furnish filler pieces to close opening between coordinator and jamb of frame. Provide mounting brackets as required for proper mounting of additional hardware.
- c. Models: Hager 297D, Door Controls 600 Series, Glynn Johnson Series "COR", or Rockwood 1600 Series.

## **2.08 CLOSERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Surface-Mounted Closers:
    - a. LCN Closers; an Ingersoll-Rand Company, 4110 Series, EDA Arm.
- B. Standards: Comply with the following:
  - 1. Closers: BHMA A156.4.
- C. Surface Closers: BHMA Grade 1, cast-iron body.
  - 1. Door closers shall have fully hydraulic, full rack and pinion action. Cylinder body shall be 1-1/2" in diameter, and double heat treated pinion shall be 11/16" in diameter.
  - 2. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and hydraulic back-check.
  - 3. All closers shall have solid forged steel main arms (and forged forearms for parallel arm closers).
  - 4. Closer arms shall be extra duty with powder coating finish.
  - 5. Provide drop, mounting plates where required.
  - 6. Do not locate closers on the side of doors facing corridors, passageways or similar type areas. Where it is necessary, due to certain conditions and approval of the Architect, to have closers in corridors, provide such closers with parallel or track type arms.
  - 7. Door closers shall be adjusted by the installer in accordance with the manufacturer's templates and written instructions. Closers with parallel arms shall have back-check features adjusted prior to installation.
  - 8. Closers shall conform to all applicable code and law requirements relative to setting closing speeds for closers and maximum pressure for operating interior and exterior doors.
- D. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

## **2.09 PROTECTIVE TRIM UNITS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Metal Protective Trim Units:
    - a. Burns Manufacturing Incorporated.
    - b. Don-Jo Mfg., Inc. .
    - c. Rockwood Manufacturing Company.
- B. Standard: Comply with BHMA A156.6.
- C. Materials: Fabricate protection plates from the following:
  - 1. Stainless Steel: 0.050 inch thick; beveled top and 2 sides.
- D. Fasteners: Provide manufacturer's oval head exposed fasteners for door trim units consisting of either machine or self-tapping screws, for installation in counter sunk holes.
- E. Furnish protection plates sized 2 inches less than door width on push side by the following height:

1. Kick Plates: 8 inches or to match existing building standard.

## **2.10 STOPS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Glynn-Johnson; an Ingersoll-Rand Company.
  2. Ives: H. B. Ives.
  3. Rockwood Manufacturing Company.
- B. Standards: Comply with the following:
  1. Stops and Bumpers: BHMA A156.16.
  2. Door Silencers: BHMA A156.16.
- C. Stops and Bumpers: BHMA Grade 1.
  1. Wall Stops: Convex with concealed mounting.
  2. Floor Stops: Dome stop, base thickness to accommodate flooring thickness; Ives 436, 438, 436x435, 438x437.
- D. Silencers for Metal Door Frames: BHMA Grade 1; neoprene or rubber, minimum diameter 1/2 inch; fabricated for drilled-in application to frame.

## **2.11 DOOR GASKETING**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Door Gasketing and Door Bottoms:
    - a. National Guard Products, Inc.
    - b. Pemko Manufacturing Co., Inc.
    - c. Reese Enterprises, Inc.
    - d. Zero International, Inc.
- B. General: Provide continuous smoke gasketing on interior doors where indicated or scheduled.
  1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
  2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- 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 10B or NFPA 252.
  1. Perimeter Gasketing Basis-of-Design Product, No. 5050 by National Guard Products or approved substitute.
  2. Astragal Basis of Design Product: Surface applied, concealed fastener Pemko 29310DPK or approved substitute.

## **2.12 THRESHOLDS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. National Guard Products
  2. Pemko Manufacturing Co., Inc.
  3. Reese Enterprises, Inc.
  4. Zero International, Inc.
- B. General: Extruded aluminum threshold-transition strip floor plate tread with fluted surface, mill finish aluminum, 1/4 inch thick by 4 inches by one piece length full width of opening. Drill to receive flat head screws located 3 inches from each end, and uniformly spaced between at not more than 16 inches on center. Provide stainless steel machine screws and expansion shields.
  1. Basis of Design: Pemko 274, 1/4" high x 4 inches with one square edge and one tapered edge.

**2.13 EXIT DEVICES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Stanley Commercial Hardware; Div. of The Stanley Works (Precision Hardware, Inc.)
  - 5. VonDuprin; an Ingersoll-Rand Company.
- B. Standards: Comply with the following:
  - 1. Surface Bolts: BHMA A156.16
  - 2. Automatic and Self-Latching Flush Bolts BHMA A156.3
- C. Surface Bolts: BHMA Grade 1
  - 1. Flush Bolt Heads: Minimum of ½ inch diameter rods of brass, bronze, or stainless steel with minimum 12 inch long rod for doors up to 84 inches in height. Provide longer rods as necessary for doors exceeding 84 inches.
- D. Flush Bolts: BHMA Grade 1, designed for mortising into door edge.
- E. Bolt Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:
  - 1. Surface Bolts: Minimum 7/8" throw
  - 2. Fire-Rated Surface Bolts: Minimum 1-inch throw; listed and labeled for fire-rated doors.
  - 3. Mortise Flush Bolts: Minimum 3/4 inch throw.
- F. Strikes: Provide matching strikes for heads of doors. Provide dust proof strikes at all floor locations.

**2.14 FABRICATION**

- A. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.
- B. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
  - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
  - 2. Steel Machine or Wood Screws: For the following fire-rated applications:
    - a. Mortise hinges to doors.
    - b. Strike plates to frames.
    - c. Closers to doors and frames.
  - 3. Spacers or Sex Bolts: For through bolting of hollow metal doors.
  - 4. Fasteners for Wood Doors: Comply with requirements of DHIWDHS.2, "Recommended Fasteners for Wood Doors."

**2.15 FINISHES**

- A. Standard: Comply with BHMA A156.18.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.



- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. BHMA Designations: Comply with base material and finish requirements indicated by the following:
  - 1. BHMA 630 (US32D): Satin stainless steel, over stainless-steel base metal.
- E. All hardware items shall be furnished in dull chrome finish<sup>26D</sup> or satin stainless steel 32D.
  - 1. Exceptions are as follows:
    - Door Closers: Sprayed Aluminum
    - Plates: 32D
    - Smoke Seals: Aluminum

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Contractor shall examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance. If errors in dimensions or preparation are encountered, they are to be corrected by the responsible parties prior to the installation of hardware.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.02 PREPARATION

- A. Steel Frames: Comply with DHI A115 series.
  - 1. Surface-Applied Door Hardware: Drill and tap frames according to SDI 107.

#### 3.03 INSTALLATION

- A. 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."
- B. Install each door hardware item to comply with manufacturer's 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 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
  - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Exit Devices shall be carefully installed so as to permit friction free operation of touch bar and lever. Latching mechanism shall also operate freely without friction or binding.
- D. Door closers shall be installed in accordance with the manufacturer's instructions. Each door closer shall be carefully installed, on each door, at the degree of opening dictated by the frame condition relative to adjacent construction and clearances to permit full swing of the door to the door stops. Arm position shall be as shown on the instruction sheets.

1. The adjustments for all door closers shall be the installer's responsibility and these adjustments shall be made at the time of installation of the door closer. The closing speed and the latching speed valves shall be adjusted individually to provide a smooth, continuous closing action without slamming. The delayed action feature or back check valve shall also be adjusted so as to permit the correct delayed action cycle or hydraulic back check cushioning of the door in the opening cycle. All valves shall be properly adjusted at the time of installation. Each door closer has adjustable spring power capable of being adjusted, in the field, from size 1 thru 6. It shall be the installer's responsibility to adjust the spring power for each door closer in exact accordance with the spring power adjustment chart illustrated in the door closer installation sheet packed with each door closer.
- E. Install aluminum threshold transition strips at locations indicated. Drill slab and fasten with machine screws and expansion anchors in predrilled holes, drawn tight and flush with the surface.

### **3.04 ADJUSTING**

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
1. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

### **3.05 CLEANING AND PROTECTION**

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

### **3.06 DOOR HARDWARE SCHEDULE**

- A. To be coordinated with Architect and Owner.

**END OF SECTION**

**SECTION 08 80 00  
GLAZING****PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.02 SUMMARY**

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
1. Glazed Storefronts and Entrances
  2. Glazed interior doors
  2. Interior Borrowed Lites
- B. Related Sections include the following:
1. Division 08 Section "Aluminum Storefront and Entrance " for aluminum doors to receive glass.
  2. Division 08 Section "Hollow Metal Doors and Frames" for factory glazing of hollow metal doors with glazed openings.
  3. Division 08 Section "Wood Doors" for factory glazing of wood doors with glazed openings.
  4. Division 08 Section "Triple Glazed uPVC Windows" for glazing of exterior windows.
  5. Division 08 Section "Exterior Stile and Rail Wood Doors and Windows" for glazing of wood storefront system.

**1.03 PERFORMANCE REQUIREMENTS**

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

**1.04 SUBMITTALS**

- A. General: Submit in accordance with Division 01 Section "General Requirements."
- B. Product Data:
1. Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
  2. Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- C. Shop Drawings:
1. Submit glazing schedule indicating all openings to be glazed and type of glazing
- D. Samples:
1. Upon request, submit 8x8 inch samples of glass units.

**1.05 QUALITY ASSURANCE**

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: GANA's "Glazing Manual."

- B. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

#### **1.06 DELIVERY, STORAGE AND HANDLING**

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature, changes, direct exposure to sun, or other causes.

#### **1.07 PROJECT CONDITIONS**

- A. Environmental limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, of other causes.
  - a. Do not install glazing sealants when ambient and substrate temperature conditions are outside limited permitted by sealant manufacturer or below 40 deg F.

### **PART 2 - PRODUCTS**

#### **2.01 GLASS PRODUCTS**

- A. Safety Glass: ASTM C 1048; Kind FT (fully tempered), Condition A (uncoated), Type I (transparent flat glass); Class 1 (clear); Quality q3 (glazing select); conforming to ANSI Z97.1; 6 mm (0.23 inch) minimum thick.

#### **2.02 INSULATING GLASS FOR ALUMINUM STOREFRONT**

- A. Low-E, Clear, Insulated Glass Units:
  - 1. Overall unit thickness:
    - a. For Exterior locations other than doors: Inner and outer panes of 6.0 mm glass; total unit thickness of 1 inch minimum.
    - b. For Exterior Doors: Inner and outer panes of 3/16" glass; total unit thickness of 5/6" minimum.
  - 2. Interspace Content: Argon.
  - 3. Provide safety glazing labeling on fully tempered glass.

#### **2.03 INSULATING GLASS FOR WOOD STOREFRONT**

- A. Low-E, Clear, Insulated Glass Units:
  - 1. Coordinate with wood storefront manufacturer's recommendations. Basis of Design as follows:
    - a. Vitro Architectural Glass
      - i. Solarban 60 Clear,
        - 1. Solar Heat Gain Coefficient: .38
  - 2. Interspace Content: Argon.
  - 3. Provide safety glazing labeling on fully tempered glass.

#### **2.04 GLAZING SEALANTS**

- A. General: Provide products of type indicated, complying with the following requirements:
  - 1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, and glazing channel substrates, under

- conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
  3. Colors of exposed glazing sealants: As selected by Architect from Manufacturer's full range.
- B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
1. Neutral-Curing Silicone Glazing Sealants: ASTM C 920, Type S, Grade NS, Class 50, Use NT.
    - a. Products:
      - 1) Dow Corning Corporation; 791 or 795
      - 2) GE Advanced Materials - Silicones; SilPruf NB SCS9000 or UltraPruf II SCS2900.
      - 3) Pecora Corporation; 895.

## **2.05 MISCELLANEOUS GLAZING MATERIALS**

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Glazing Tape: Of type and size for installation conditions.

## **2.06 FABRICATION OF GLAZING UNITS**

- A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine framing glazing, with Installer present, for compliance with the following:
  1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  2. Minimum required face or edge clearances.
  3. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

### **3.03 GLAZING, GENERAL**

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions, as indicated on hollow metal framing shop drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance. Protect glass edges as follows:
  - 1. Use a rolling block in rotating glass units to prevent damage to glass corners.
  - 2. Do not impact glass with metal framing.
  - 3. Use suction cups to shift glass units within openings. Do not raise or drift glass with a pry bar.
  - 4. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications and standards, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

### **3.04 GASKET GLAZING (DRY)**

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gasket to produce a

weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

### **3.05 SEALANT GLAZING (WET)**

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass. Install pressurized gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

### **3.06 CLEANING AND PROTECTION**

- A. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.
- B. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- C. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

**END OF SECTION**

## **SECTION 08 83 00 MIRRORS**

### **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 the following types of silvered flat glass mirrors:
  - 1. Film-backed glass mirrors qualifying as safety glazing.

#### **1.03 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, and glass coating components.
- B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

#### **1.05 WARRANTY**

- A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

### **PART 2 - PRODUCTS**

#### **2.01 SILVERED FLAT GLASS MIRRORS**

- A. Mirrors, General: ASTM C 1503.



- B. Annealed Monolithic Glass Mirrors: Mirror Glazing Quality, clear .
  - 1. Nominal Thickness: 6.0 mm.
- C. Safety Glazing Products: For film-backed mirrors, provide products that comply with 16 CFR 1201, Category II.

## **2.02 MISCELLANEOUS MATERIALS**

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
- D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.
- E. Decorative Rosettes: Victorian-style stamped antiqued silver rosettes in floral pattern, 1 inch diameter with black felt pads and vinyl screw cushion sleeves.
  - 1. Supplier: Angel Gilding 866-341-3340; <http://angelgilding.com/A4087.html>, SKU#: 4087.

## **2.03 FABRICATION**

- A. Fabricate mirrors in the shop to greatest extent possible.
- B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
- C. Mirror Edge Treatment: Flat polished.
  - 1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
  - 2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.
- D. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint, as recommended in writing by film-backing manufacturer, to produce a surface free of bubbles, blisters, and other imperfections.
- E. Drill mirror for installation of decorative rosettes.

**PART 3 - EXECUTION****3.01 EXAMINATION**

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
- B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

**3.02 PREPARATION**

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

**3.03 INSTALLATION**

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
  - 1. GANA Publications: "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
- B. Provide a minimum airspace of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
- C. Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
  - 1. Install mastic as follows:
    - a. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
    - b. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch (3 mm) between back of mirrors and mounting surface.
    - c. Support mirror in place until mastic has cured.
  - 2. Install decorative rosettes with screws through vinyl screw cushion sleeves. Do not over tighten or apply pressure to mirror that would apply stress to mirror glass.

**3.04 CLEANING AND PROTECTION**

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror

manufacturer.

**END OF SECTION**

**SECTION 09 29 50  
GYPSUM BOARD ASSEMBLIES**

**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.02 SUMMARY**

- A. This Section includes the following:
  - 1. Interior gypsum wallboard.
  - 2. Acoustical insulation and sealants.
  - 3. Non-load-bearing steel framing.
  - 4. Patching.
- B. Related Sections include the following:
  - 1. Division 06 Section "Rough Carpentry" for wood blocking.
  - 2. Division 07 Section "Thermal Insulation" for thermal insulation at exterior walls.

**1.03 DEFINITIONS**

- A. Gypsum Board Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

**1.04 SUBMITTALS**

- A. General: Submit in accordance with Division 01 Section "General Requirements."
- B. Product Data: For each type of product indicated.

**PART 2 - PRODUCTS****2.01 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
  - 2. Products: Subject to compliance with requirements, provide one of the products specified.

**2.02 STEEL PARTITION FRAMING**

- A. Manufacturers:
  - 1. Clark Dietrich Building Systems.
  - 2. Super Stud Building Products, Inc.
- B. Components, General: As follows:
  - 1. Comply with ASTM C 754 for conditions indicated.
  - 2. Steel Sheet Components: Complying with ASTM C 645 requirements for metal and with ASTM A 653/A 653M, G40, hot-dip galvanized zinc coating. Substitute coating not permitted.
- C. Steel Studs and Runners: ASTM C 645.
  - 1. Gauge Equivalent Drywall Framing: For all studs locations, Minimum Design Thickness 0.023inches.
    - a. Clark Dietrich ProSTUD 20.
    - b. Super Stud The Edge Super 20.

2. Depth: As indicated.
- D. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members to substrates involved; complying with recommendations of gypsum board manufacturers for applications indicated.

### **2.03 INTERIOR GYPSUM WALLBOARD**

- A. Manufacturers:
  1. G-P Gypsum Corporation.
  2. National Gypsum Company.
  3. United States Gypsum Company.
- B. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- C. Gypsum Wallboard, GPDW: ASTM C 36.
  1. Type X:
    - a. Thickness: 5/8 inch.
    - b. Long Edges: Tapered.
- D. Moisture and Mold Resistant Type, MR GPDW: ASTM C 630 with moisture-and-mold resistant core and surfaces.
  1. Thickness: 5/8 inch, Type X
  2. Long Edges: Tapered.
  3. Mold-Resistance: ASTM D3273, rating of 10
  4. Location: Interior face of toilet room walls (non-tiled)
- E. Glass-Mat, Water-Resistant Tile Backing Board: ASTM C 1178.
  1. Product: Dens-Shield Tile Backer; G-P Gypsum Corp.
  2. Core 5/8" inch, Type X
  3. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
  4. Location: Behind ceramic tile.

### **2.04 TRIM ACCESSORIES**

- A. Interior Trim: ASTM C 1047, galvanized steel.
  1. Shapes:
    - a. Cornerbead: 1-1/4 inch x 1-1/4 inch external corner with 1/8-inch nose bead. Use at outside corners, unless otherwise indicated.
    - b. LC-Bead (Casing): J-shaped casing with 1/16-inch nose bead ground, not less than 30 gage; exposed long flange receives joint compound;
- B. Aluminum Trim: Extruded accessories of profiles and dimensions to match existing.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Fry Reglet Corp.
    - b. Gordon, Inc.
    - c. MM Systems Corporation.
    - d. Pittcon Industries.
  2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, alloy 6063-T5.
  3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.
  4. Reveal Profile: Match existing width and depth.

## **2.05 JOINT TREATMENT MATERIALS**

- A. General: Comply with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.
- B. Joint Tape:
  - 1. Interior Gypsum Wallboard: Paper reinforcing tape. Fiberglass tape not permitted.
- C. Setting-Type Joint Compound: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
  - 1. Provide sandable type for finish coat.
- D. Type of Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints, beveled panel edges, and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
  - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
  - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.

## **2.06 ACOUSTICAL SEALANT**

- A. Products:
  - 1. Acoustical Sealant :
    - a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
    - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

## **2.07 AUXILIARY MATERIALS**

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
  - 1. Fastening gypsum board to steel members: Type S bugle head.
- C. Sound Attenuation Blankets (Acoustical Insulation): ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
  - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Certainteed.
    - b. Owens Corning.
    - c. Johns Manville.

## **PART 3 - EXECUTION**

### **3.01 INSTALLING STEEL FRAMING, GENERAL**

- A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.
- B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, grab bars, toilet accessories, wall mounted door stops or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."

- C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.
  - 1. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.
    - a. Install deflection track top runner or deflection brackets to attain lateral support and avoid axial loading.

### **3.02 INSTALLING STEEL PARTITION FRAMING**

- A. Install tracks (runners) at floors and ceilings where gypsum board assemblies abut other construction.
- B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch from the plane formed by the faces of adjacent framing.
- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, unless otherwise indicated.
  - 1. Provide additional framing to support gypsum board on both sides of control joints.
- D. Install steel studs and furring at the following spacings:
  - 1. Single-Layer Construction: 16 inches o.c., unless otherwise indicated.
- E. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.
  - 1. Attach both flanges to floor runner track with screws.

### **3.03 INSTALLATION OF ACOUSTICAL INSULATION**

- A. Install acoustical insulation at locations indicated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement.
- B. Install a single layer of insulation of required thickness to fill the full depth of cavity, unless otherwise shown. Where cavity requires insulation that is thicker than standard size, install next larger size and compress into cavity.
- C. Hold batt insulation in place with insulation support anchors located at 5 feet on center, full height of wall, starting at the top of each stud space.
- D. Stuff glass fiber loose fill insulation into miscellaneous voids and cavity spaces. Fill box headers, and voids while framing is being erected that will be inaccessible for installation later. Compact to approximately 40 percent of normal maximum volume (to a density of approximately 2.5 pcf).

### **3.04 APPLYING AND FINISHING PANELS, GENERAL**

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216, except as specified otherwise.
- B. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- C. Locate edge and end joints over supports. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions.
- D. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- E. Attach gypsum panels to framing provided at openings and cutouts.

- F. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
- G. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
  - 1. Space screws a maximum of 12 inches o.c. for vertical applications.
- H. Remove screws that do not hit studs, supports, or blocking.

### **3.05 INSTALLING TRIM ACCESSORIES**

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Install corner bead at external corners.
- C. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange formed to receive joint compound, except where other types are indicated.
  - 1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
  - 2. Install L-bead where edge trim can only be installed after gypsum panels are installed.
  - 3. Install U-bead where indicated.
- D. Aluminum Trim: Install with mitred corners to match existing configuration.

### **3.06 FINISHING GYPSUM BOARD ASSEMBLIES**

- A. General: Treat gypsum board joints, interior angles, flanges of corner bead, edge trim, J-bead, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, beveled edges, and damaged surface areas using setting-type joint compound.
- C. Apply joint tape over gypsum board joints and to flanges of trim accessories as recommended by trim accessory manufacturer.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
  - 1. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
    - a. Provide skim coat finish where existing resilient wall base is removed.
- E. For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.
  - 1. At tapered edge joints, draw compound down to a level plane, leaving a monolithic surface that is flush with the paper face. Finish coat shall be feathered a minimum of 8 inches beyond both sides of center of joint tape.
  - 2. At end-to-end butt joints, draw compound down to minimize hump created by joint tape application. Finish coat shall be feathered a minimum of 16 inches beyond both sides of center of joint tape.
  - 3. End product shall be a surface that appears level without telegraphing joint locations as high spots when viewed down wall after painting.
  - 4. Finish board to within 1/4 inch of floor, providing full support for resilient wall base without telegraphing joint.
- F. Patching: Inspect existing walls scheduled to be painted for dents, holes, damage and blemishes.



Fill holes, blemishes, and surfaces disturbed by the work with compound to blend with adjacent surfaces. Tape and blend finish into existing gypsum board to a Level 4 finish, so joints are unperceivable after paint finish is applied.

1. At locations where existing wall base is removed and scheduled to receive new wall base, skim coat surface to remove irregularities, making wall surface smooth and level to receive new wall base.

### **3.07 CLEANING AND PROTECTION**

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

**END OF SECTION**

**SECTION 09 31 00  
TILE****PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.02 SUMMARY**

- A. This Section includes the following:
  - 1. Ceramic mosaic tile.
  - 2. Glazed wall tile, including trim units.
  - 3. Waterproof membrane for thin-set tile installations.
  - 4. Crack-suppression membrane for thin-set tile installations.

**1.03 SUBMITTALS**

- A. General: Submit in accordance with Division 01 Section "General Requirements."
- B. Product Data: For each type of product indicated.

**1.04 QUALITY ASSURANCE**

- A. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.
  - 1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
  - 1. Waterproofing.
  - 2. Crack-suppression membrane.
- D. Preinstallation Conference: Conduct conference at Project site.
  - 1. Assemble all trades working at Project site to coordinate the work and to prevent workers from walking on newly installed tiles for required setting bed and grout cure times. Large tile will require additional time for the mortar bed to cure. Contractor to coordinate project schedule to complete work by other trades and vacate areas receiving floor coverings, stopping pedestrian traffic over newly installed flooring installation until curing and drying period is complete. Contractor shall conduct periodic coordination meetings with all trades to review schedule and procedures to prevent interference and damage during installation and curing and drying periods of floor coverings.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile

packages.

- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
  - 1. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.
- C. Store liquid materials in unopened containers and protected from freezing.

#### **1.06 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient and substrate temperatures and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.
  - 1. Maintain temperatures at 50 deg F or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

### **PART 2 - PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.

#### **2.02 PRODUCTS, GENERAL**

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
  - 1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.
  - 1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

#### **2.03 TILE PRODUCTS**

- A. Unglazed Ceramic Mosaic Tile, FL-8: Factory-mounted flat tile as follows:
  - 1. Composition: Porcelain.
  - 2. Module Size: 2-inch square.
  - 3. Thickness: 3/8"
  - 4. Surface: Unpolished.

5. Product: Colorbody Porcelain: Fabrique; Daltile, Div. of Dal-Tile International Inc.
  - a. Pattern: Coordinate with Architect in Field
  - b. Color(s): As indicated on Materials Legend.
- B. Glazed Wall Tile, CT-1; Flat tile as follows:
  1. Module Size: 13- by 40-inches.
  2. Thickness: 3/8 inch.
  3. Face: Pattern of design indicated, with manufacturer's standard edges.
  4. Finish: Matte.
  5. Trim Units: None required;
  6. Product: Ruggine; Porcelanosa.
    - a. Color: Aluminio
- C. Glazed Wall Tile, CT-2; Flat tile as follows:
  1. Module Size: 4 1/2- by 12-inches.
  2. Thickness: 5/16 inch.
  3. Face: Pattern of design indicated, with manufacturer's standard edges.
  4. Finish: Matte.
  5. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:
    - a. Base for Thin-Set Mortar Installations: Coved, module size 4-1/4 by 12 3/4" inches, Style A-34C1.
    - b. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size 4 1/4- by 12 7/8-inches, Style S-44C9.
  6. Product: Modern Dimensions; Daltile, Div. of Dal-Tile International Inc.
    - a. Colors: As indicated on Materials Legend.
- D. Outside Corner Tile Accessory:
  1. Size: 5/16 inch.
  2. Material: Satin Anodized aluminum
  3. Product: Schluter-INDEC (80AE)

## **2.04 THRESHOLDS**

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes. Provide stone that is uniform in color and finish.
  1. Bevel edges at 1:2 slope, aligning lower edge of bevel with adjacent floor finish. Limit height of bevel to 1/2 inch or less, and finish bevel to match face of threshold.
- B. Marble Thresholds: ASTM C 503 with a minimum abrasion resistance of 12 per ASTM C 1353 or ASTM C 241 and with honed finish.
  1. Comply with MIA Group "A" for soundness.
  2. Size: 2 inches wide by full width of opening; one-piece length.
  3. Description: Uniform, fine- to medium-grained white stone with veining. Color to be selected by the Architect from manufacturer's standard colors.

## **2.05 WATERPROOF MEMBRANE FOR THIN-SET TILE INSTALLATIONS**

- A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

- B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
  - 1. Products:
    - a. LATICRETE International Inc.; Laticrete 9235 Waterproof Membrane.
    - b. MAPEI Corporation; Mapelastic HPG with MAPEI Fiberglass Mesh.

## **2.06 CRACK ISOLATION MEMBRANE FOR THIN-SET TILE INSTALLATIONS**

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of a two-part, liquid rubber and fabric reinforcement.
  - 1. Products:
    - a. Laticrete International, Inc.; Laticrete Blue 92 Anti-Fracture Membrane.
    - b. MAPEI Corporation; Mapelastic AquaDefense with MAPEI Fiberglass Mesh .

## **2.07 SETTING AND GROUTING MATERIALS**

- A. Latex-Portland Cement Mortar (Thin Set) and Grout: ANSI A118.4 and ANSI A118.6 respectively, consisting of the following:
  - 1. Prepackaged premium dry-mortar mix combined with acrylic resin liquid-latex additive.
    - a. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.
  - 2. Products:
    - a. LATICRETE; Laticrete 254 Platinum.
    - b. MAPEI; Ultraflex 3.
  - 3. Grout Colors: As indicated on Materials Legend; in locations not indicated, as selected by Architect from manufacturer's full range of colors.

## **2.08 ELASTOMERIC SEALANTS**

- A. General: Provide backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."

- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.
- C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
  - 1. Products:
    - a. Laticrete International, Inc.; Latasil Tile & Stone Sealant.

## **2.09 MISCELLANEOUS MATERIALS**

- A. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- B. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.
  - 1. Products:
    - a. Bostik, Inc.; CeramaSeal Grout & Tile Sealer.
    - b. C-Cure; Penetrating Sealer 978.
    - c. MAPEI Corporation; KER 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.
    - d. TEC; a subsidiary of H. B. Fuller Company; TA-256 Penetrating Silicone Grout Sealer.

## **2.10 MIXING MORTARS AND GROUT**

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions, including those for accurate proportioning of materials, water, or additive content; type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics for application indicated.
- B. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

# **PART 3 - EXECUTION**

## **3.01 EXAMINATION**

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
  - 1. Verify that installation of electrical, plumbing and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## **3.02 PREPARATION**

- A. Grind existing concrete floors to remove existing adhesives or coatings detrimental to

achieving bond for new tile flooring.

- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- D. Where wall tile is to be applied to existing painted plaster walls, sand surface to completely scarify the surface.

### **3.03 INSTALLATION, GENERAL**

- A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.
- C. Lay tile in patterns indicated. When field conditions conflict with indicated pattern, notify Architect in writing prior to installation for review and approval of revisions.
- D. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- E. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile. Top setting of coved base is not permitted.
- F. Tile shall lay flat and each edge flush with adjacent tile, free of tilting and skewed tile. Provide additional setting material to shim accent tiles that are thinner than field tiles so face is in same plane.
- G. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area, unless indicated otherwise. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
  - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
- H. Lay out tile wainscots to next full tile beyond dimensions indicated.
- I. Grout tile to comply with requirements of the following tile installation standards:
  - 1. For ceramic tile grouts (latex-portland cement grouts), comply with ANSI A108.10.

### **3.04 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANE INSTALLATION**

- A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to

substrate.

1. Turn membrane up walls as follows to keep water from traveling under partitions:
  - a. Toilet Rooms with Tile Floors on Elevated Slabs: 2 inches minimum at perimeter walls of rooms.
- B. Install crack-suppression membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.
  1. Install fabric reinforcement in crack-suppression membrane at all cracks, saw cuts and room perimeter sealing.
  2. At Toilet Rooms on slabs-on-grade with tile floors, seal perimeter of room by running membrane with reinforcement fabric up wall 2 inches minimum and out onto the floor 4 inches minimum.
- C. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

### **3.05 FLOOR TILE INSTALLATION**

- A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.
  1. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.
    - a. Tile floors in wet areas.
- B. Joint Widths: Install tile on floors with the following joint widths:
  1. 2" x 2" Ceramic Tile: 1/8 inch.
- C. Stone Thresholds: Install stone thresholds in same type of setting bed as abutting field tile, unless otherwise indicated.
  1. Do not extend waterproofing or crack isolation membrane under thresholds set in latex- portland cement mortar. Fill joints between such thresholds and adjoining tile set on waterproofing or crack isolation membrane with elastomeric sealant.
- D. Grout Sealer: Apply grout sealer to grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

### **3.06 WALL TILE INSTALLATION**

- A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.
- B. Joint Widths: Install tile on walls with the following joint widths:
  1. Glazed Wall Tile CT-1: 1/16 inch.

### **3.07 CLEANING AND PROTECTING**

- A. Remove and replace material that is stained or otherwise damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.



1. Remove latex-portland cement grout residue from tile as soon as possible.
  2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
- C. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- D. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- E. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

### **3.08 TILE INSTALLATION SCHEDULE**

- A. Ceramic Tile over Concrete Floors on Grade: Thin-set latex portland cement mortar over crack suppression membrane at saw cuts and random cracks, TCA F125 - Partial. Apply joint sealer to tile joints.
1. At toilet and shower rooms on grade, seal perimeter of room by running membrane up wall 2 inches minimum and out on the floor 4 inches.
- B. Wall Tile on Glass-Mat, Water Resistant Backer Board, Thin Set: Latex portland cement mortar tile setting bed, TCA W245. Apply joint sealer to tile joints.

**END OF SECTION**

**SECTION 09 51 00  
ACOUSTICAL PANEL CEILINGS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.02 SUMMARY**

- A. This Section includes the following:
  - 1. Acoustical panels.
  - 2. Exposed suspension systems.
- B. Related Sections include the following:
  - 1. Division 23, and 26 Sections for coordination of air handling devices, and luminaires installed in ceiling systems.

**1.03 SUBMITTALS**

- A. General: Submit in accordance with Division 01 Section "General Requirements."
- B. Product Data: For each type of product indicated.

**1.04 QUALITY ASSURANCE**

- A. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
  - 1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
    - a. Smoke-Developed Index: 450 or less.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes. Store materials flat.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

**1.06 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not install acoustical panel ceilings until wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Mechanical, electrical, and other utility service installations above the ceiling plane shall have been completed prior to the installation of the ceilings.

**1.07 COORDINATION**

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, and partition assemblies.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
1. Products: Subject to compliance with requirements, provide one of the products specified.

**2.02 ACOUSTICAL PANELS, GENERAL**

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
  2. Test Method for Ceiling Attenuation Class (CAC). Where acoustical panel ceilings are specified to have a CAC, provide units identical to those tested per ASTM E 1414 by a qualified testing agency.
- B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
- C. Coating-Based Antimicrobial Treatment: Provide acoustical panels with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273.

**2.03 ACOUSTIC PANELS**

- A. Acoustic Panel: C-3.
1. Size: 24 inches x 24 inches x 3/4-inch thick.
  2. Composition: Mineral wool fiber.
  3. Surface Finish: Factory-applied latex paint; white.
  4. Surface Texture: Fine texture.
  5. Edge: Beveled tegular.
  6. NRC Range: 0.50.
  7. CAC Range: 35.
  8. Fire Hazard Classification: Class A, 0 - 25 flame spread.
  9. Dimensional Stability: Sag resistant at high humidity.
  10. Antimicrobial Treatment: Coating based, front and back.
  11. Product:
    - a. Armstrong World Industries, Inc.; Ultima No. 11912HRC; Wall-to-wall and Discontinuous/Open Plenum as shown on Drawings.
    - b. Axiom Classic Trim – provide angle and outside corner molding as required

**2.04 METAL SUSPENSION SYSTEMS, GENERAL**

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
- B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  - 1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

## **2.05 METAL SUSPENSION SYSTEMS FOR ACOUSTICAL PANEL CEILINGS**

- A. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation, with prefinished 15/16-inch- wide metal caps on flanges.
  - 1. Structural Classification: Heavy-duty system.
  - 2. End Condition of Cross Runners: Override (stepped) or butt-edge type, as standard with manufacturer.
  - 3. Face Design: Flat, flush.
  - 4. Cap Material: Steel or aluminum cold-rolled sheet, as standard with manufacturer.
  - 5. Cap Finish: Painted white.
  - 6. Products:
    - a. Armstrong World Industries, Inc.; Prelude XL Exposed Tee System.

## **2.06 ACCESSORIES**

- A. Provide means of locating valves and other items requiring maintenance or access, which are located concealed above ceiling panels. The identification shall be color coded to match the color coding issued by the University Director of Utilities for heating and plumbing lines.
  - 1. Provide phenolic tags to locate valves and controls above ceiling mechanically attached to ceiling grid.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with dimensions and layout shown on reflected ceiling plans.
- B. Confirm all acoustic tile layout with Architect in field prior to installation of any grid.

### **3.03 INSTALLATION OF SUSPENSION SYSTEMS AND ACOUSTICAL CEILING PANELS, GENERAL**

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 requirements indicated, per manufacturer's written instructions and Cisca's "Ceiling Systems Handbook."

- B. Suspend ceiling hangers from building's structural members and as follows:
1. Hangers shall be single lengths of wire without splices; coordinate lengths in deep ceiling cavities.
  2. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  3. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
  5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to postinstalled mechanical or power-actuated fasteners that extend through forms into concrete.
  7. Do not attach hangers to steel deck tabs.
  8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
  9. Exposed pop rivets for grid alignment purposes shall not be permitted.
- C. Suspension system shall be reinforced to support diffusers, light fixtures and any additional members. Install hanger wires to grid at each corner of light fixtures. Coordinate location with electrical and other trades.
1. Each individual fixture and attachment with combined weight of 56 pounds or less shall have two 12-gage wire hangers attached at diagonal corners of the fixture. These wires shall be slack. Fixtures and attachments with a combined weight of greater than 56 pounds shall be independently supported from the structure at all four corners.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
  2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels to run in the same direction.
  2. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
  3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
- G. Locating Tags: Where valves and controls are located above acoustical ceilings, mechanically

attach identification tags to ceiling grid.

**3.04 CLEANING NEWLY INSTALLED WORK**

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

**END OF SECTION**

**SECTION 09 54 00  
SPECIALTY WOOD CEILINGS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.02 SUMMARY**

- A. This Section includes the following:
1. Non-perforated wood ceiling panels.
  2. Acoustical backing
  3. Suspension systems
  4. Accessories: provide other necessary items include devices for attachment overhead construction, secondary members, splines, splices, connecting clips, wall connectors, wall angles, and other devices required for a complete installation.
  5. Supplemental support framing. Provide fully engineered secondary framing as required to meet code, conforming to layout shown in drawings, to support direct-hung wood ceilings suspension system.
- B. Related Sections include the following:
1. Division 09 Section Gypsum Board Assemblies"
  2. Division 09 Section "Acoustical Ceilings"
  3. Division 23, and 26 Sections for coordination of air handling devices, and luminaires installed in ceiling systems.
- C. This Section covers the general requirements only for Specialty Wood Ceilings as shown on the drawings. The supplying and installation of additional accessory features and other items not specifically mentioned herein, but which are necessary to make a complete installation, shall also be included or clarified accordingly.
- D. Qualification Data:
1. Test Reports: Certified reports from independent agency substantiating structural compliance to windloads and other governing requirements.
  2. Certificates:
    - a. Data substantiating manufacturer and installer qualifications.
    - b. Certified data attesting fire rated materials comply with specifications.
  3. Manufacturer's Instructions: Detailed installation instructions and maintenance data.

**1.03 REFERENCES**

- A. American Society for Testing and Materials (ASTM)
1. E 84 – "Standard Test Method for Surface Burning Characteristics of Building Materials"
  2. E 488 – "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements"
  3. C 423 – "Sound Absorption and Sound Absorption Coefficients by Reverberation Room Method"
  4. E 580 – "Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint"
  5. C 635 – "Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings"
  6. C 636 – "Recommended Practice for Installation of Metal Ceiling Suspensions Systems for Acoustical and Lay-in Panels"
  7. A 641 – "Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire"
  8. A 653 – "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip process."

9. E 1264 – “Classification for Acoustical Ceiling Products”
10. E 1477 – “Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers”
11. D 1044 – Practice for Abrasion Resistance
12. D 1002 – Practice for Adhesion Resistance

#### **1.04 SUBMITTALS**

- B. Product Data: Manufacturer’s published literature, including specifications.
- C. Product Certification: Manufacturer’s certifications that products comply with specified requirements and governing codes including product data, laboratory test reports and research reports showing compliance with specified standards.
- D. Shop Drawings: Submit shop drawings for reflected ceiling plans (RCP’s), drawn to scale, and indicating penetrations and ceiling mounted items. Show the following details:
  1. Reflected Ceiling Plan(s): Indicating wood ceiling layout, ceiling mounted items and penetrations.
  2. Suspension System, Carrier and Component Layout.
  3. Details of system assembly and connections to building components.
- E. Samples for Verification: Full-size units (or as specified below) of each type of ceiling assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics. Submit samples for each type specified.
  1. 11” square wood panel units.
  2. 11” long samples of each exposed molding or trim.
  3. 11” long samples of each suspension component.

#### **1.05 QUALITY ASSURANCE**

- F. Manufacturer/Installer Qualifications:
  1. Provide wood ceiling system components produced by a single manufacturer with a minimum 5 years’ experience in actual production of specified products and with resources to provide consistent quality in appearance and physical properties, without delaying the work.
  2. Provide suspension system components produced by a single manufacturer to provide compatible components for a complete wood ceiling system installation.
  3. Perform installations using a firm with installers having no less than 3 years of successful experience on projects of similar size and requirements.
- G. Regulatory Requirements:
  1. Fire Rating Performance Characteristics: Install system to provide a flame spread of 0 - 25, complying with certified testing to ASTM E 84.
  2. Structural Criteria: Install and certify system to comply with structural and wind load requirements of governing codes.
  3. Installation Standard for Suspension System: Comply with ASTM C 636.
- H. Mock-Up: Prior to beginning installation erect a mock-up section, where directed, using all system components.
- I. Pre-installation Conference: Conduct a conference, prior to start of installation, to review system requirements, shop drawings, and all coordination needs.

#### **1.06 DELIVERY, STORAGE AND HANDLING**

- J. Deliver system components in manufacturer’s original unopened packages, clearly labeled.



- K. Store components in fully enclosed dry space in which HVAC systems are functioning and in continuous operation. Carefully place on skids, to prevent damage from moisture and other construction activities. Panels must remain in cartons until installation, which must be stored in a flat, horizontal position.
- L. Handle components to prevent damage to surfaces and edges, and to prevent distortion, soiling, and other physical damage.

#### **1.07 PROJECT CONDITIONS**

- M. Begin system installations only after spaces are enclosed and weather-tight, and after all wet work and overhead work have been completed.
- N. Prior to starting installations, allow materials to reach ambient room temperature and humidity intended to be maintained for occupancy. Natura Wood ceiling panels must reach room temperature and have a stabilized moisture content for a minimum of 72 hours prior to installation. Relative humidity 25% - 55% and temperatures 50°F - 86°F must be maintained throughout the life of the product.

#### **1.08 WARRANTY**

- O. Provide specified manufacturer's warranty against defects in workmanship, discoloration, or other defect considered undesirable by the Architect or Employer.
- P. This warranty shall remain in effect for a minimum period of one (1) year from date of initial acceptance.

#### **1.09 MAINTENANCE & EXTRA MATERIALS**

- Q. Maintenance Instructions: Provide manufacturers standard maintenance and cleaning instructions for finishes provided.
- R. Extra Materials: Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents. Only typical system components are included with attic stock.
  - 1. Wood Ceiling Pan Units: Full-size units equal to two percent (2%) of amount installed.
  - 2. Ceiling Suspension System Components: Quantity of each grid and exposed component equal to two percent (2%) of amount installed.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURER**

- A. Provide Natura™ NEO™ Linear wood panel ceiling system manufactured by Hunter Douglas Architectural, Inc., 5015 Oakbrook Parkway, Suite 100, Norcross, GA 30093, USA. (800) 366-4327

#### **2.02 SYSTEM MATERIALS**

- A. Linear wood panel ceiling system for interior installations:
- B. Panel Profile Type: Fire Resistant (Class A per ASTM E 84) MDF substrate, veneered on exposed faces, with a total thickness of 1-3/4". Panels are square-edged with a 3/4" reveal.
  - 1. Width: 3-5/8"
- C. Suspension System:
  - 1. Carrier: Natura Linear Carrier suspended by 12 gang hanger wire or rod.
- D. Perforations: Non-Perforated only.

- E. Panel Finish: Wood veneer; see website for full color list. FSC available.

### **2.03 ACCESSORY MATERIALS**

- A. Wall Moldings/Trim – Veneered Aluminum Extruded Edgeline Trim, Height: 4"
- B. Clips: Manufacturer's standard hold-down, security, and seismic clips.

## **PART 3- EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates and structural framing to which wood panels attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect installation and anchorage, and other conditions affecting performance of wood panel ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.
- B. Measure each ceiling area and establish layout of wood pan units to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width units at borders, and comply with layout shown on reflected ceiling plans.
- C. Survey substrate for wall attachment to assure squareness and proper elevation for wall panel installation.

### **3.03 INSTALLATION**

- A. General: Install wood pan ceilings, per manufacturers shop drawings provided, per manufacturer's written instructions and to comply with publications referenced below.
  - 1. CISCA "Ceiling Systems Handbook."
  - 2. Standard for Ceiling Suspension System Installations - ASTM C 636.
  - 3. Standard for Ceiling Suspension Systems Requiring Seismic Restraint - ASTM E 580
  - 4. IBC (International Building Code) standard for Seismic Zone for local area.
- B. Suspend ceiling hangers from building's approved structural substrates and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
  - 3. Where width of ducts and other construction within ceiling plenum produce hanger spacings that interfere with location of hangers at spacing required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Utilize supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
  - 4. Where used secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  - 5. Space hangers not more than 48" on-center, along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8" from ends of each member. Supply supporting calculations from licensed Structural Engineer verifying hanger spacing meets all requirements, when spacing exceed those recommended.
  - 6. Level grid to 1/8" in 10 feet from specified elevation(s), square and true.
  - 7. Adjust suspension system runners so they are square (within .5 degree from 90 degrees) and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

- C. Secure bracing wires to ceiling suspension members and to supports acceptable to Architect / Engineer and or inspector. Suspend bracing from building's structural members and / or structural deck, as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs(unless directed otherwise).
- D. Install edge moldings and trim of type indicated at perimeter of ceiling area and where necessary to conceal edges of wood pan. Method of edge trim attachment and design of edge trims to be approved by Architect.
  - 1. Screw attach moldings to substrate at intervals not more than 18" on-center and not more than 6" from ends, leveling with ceding suspension system to a tolerance of 1/8" in 10'. Miter corners accurately and connect securely.
  - 2. Do not use exposed fasteners, including pop rivets, on moldings and trim without prior written approval, or unless detailed otherwise.
- E. Scribe and cut wood panel units for accurate fit at penetrations by other work through ceilings.
- F. Install wood panel units in coordination with suspension system.
  - 1. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.
  - 2. Prior to Substantial Completion, clean down the horizontal wood ceiling once.

#### **3.04 ADJUST AND CLEAN**

- A. Adjust components to provide uniform tolerances.
- B. Replace all ceiling panels that are scratched or otherwise damaged.
- C. Dust or wipe exposed surfaces with a damp cloth. Use non-solvent, non-abrasive commercial type cleaner as needed.

**END OF SECTION**

**SECTION 09 65 00  
RESILIENT FLOORING**

**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. Resilient Linoleum Sheet Flooring
  - 2. Resilient Tile Flooring
  - 3. Resilient base.
  - 4. Independent testing of concrete.
  - 5. Surface preparation of concrete slabs after removal of existing floor coverings.
- B. Related Sections Include the following:
  - 1. Division 03 Section "Rehabilitation of Concrete Slabs".

**1.03 REFERENCES**

- A. Forbo Installation Guide
- B. Forbo Floor Care Guide
- C. American Society for Testing Materials:
  - 1. ASTM F 1861 Standard Specification for Resilient Wall Base.
  - 2. 2. ASTM F 1869 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
  - 3. 3. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
  - 4. 4. ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

**1.04 SUBMITTALS**

- A. General: Submit in accordance with Division 01 Section "General Requirements."
- B. Product Data: For each type of product indicated.
- C. Samples for Initial Selection:
  - 1. Resilient Accessories: Actual pieces of specified colors of all flooring materials.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver resilient flooring materials and installation accessories to Project site in original manufacturer's unopened cartons and containers each bearing name of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store resilient flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces and rolls upright.

**1.06 PROJECT CONDITIONS**

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient flooring during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during resilient flooring installation and for 48 hours after installation.
- D. Install resilient flooring after other finishing operations, including painting, have been completed.

**PART 2 - PRODUCTS****2.01 RESILIENT LINOLEUM SHEET FLOORING**

- A. Linoleum Sheet Flooring, FL-1.
  - 1. Products:
    - a. Marmoleum Concrete; Forbo Flooring, Inc. (800) 842-7839
    - b. Homogeneous linoleum sheet made of primarily of natural materials consisting of linseed oil, wood flour, and rosin binders, mixed and calendared onto natural jute backing. Pattern and color shall extend throughout total thickness of material.
  - 2. Width: 2 meters (79")
  - 3. Length: 32 Meters (105 linear feet)
  - 4. Gauge: 2.5mm (1/10")
  - 5. Backing: Jute
  - 9. Pattern and Color: As indicated in Materials Legend. Coordinate with Architect in Field.
  - 6. Adhesive: Forbo Sustain 885m Adhesive or Forbo Sustain 1195 Adhesive; selection based on moisture testing. Confirm with Manufacturer's representative.
  - 7. Topshield 2™ Finish: Applied during the manufacturing process.
  - 10. Colors and Patterns: As indicated in Materials Legend. Coordinate with Architect in Field.
- B. Linoleum Sheet Flooring, FL-2, FL-3, FL-4.
  - 1. Products:
    - a. Marmoleum Fresco; Forbo Flooring, Inc. (800) 842-7839
    - b. Homogeneous linoleum sheet made of primarily of natural materials consisting of linseed oil, wood flour, and rosin binders, mixed and calendared onto natural jute backing. Pattern and color shall extend throughout total thickness of material.
  - 2. Width: 2 meters (79")
  - 3. Length: 32 Meters (105 linear feet)
  - 4. Gauge: 2.5mm (1/10")
  - 5. Backing: Jute
  - 11. Pattern and Color: As indicated in Materials Legend. Coordinate with Architect in

Field.

6. Adhesive: Forbo Sustain 885m Adhesive or Forbo Sustain 1195 Adhesive; selection based on moisture testing. Confirm with Manufacturer's representative.
7. Topshield 2™ Finish: Applied during the manufacturing process.
12. Colors and Patterns: As indicated in Materials Legend. Coordinate with Architect in Field.

## **2.02 RESILIENT TILE FLOORING**

### **A. Flooring, FL-5, FL-6.**

1. Products:
  - a. Marmoleum Fresco; Forbo Flooring, Inc. (800) 842-7839
2. Description: Flocked textile floor covering has 100% nylon type wear layer with an intermediate fiberglass layer and a recycled vinyl cushioned base.
3. Size: Approx. 20" x 20" (50cm x 50cm)
4. Carton Size: 12 tiles (32.3 feet<sup>2</sup> , 3 meters<sup>2</sup> )
5. Gauge: 0.21" (5.3mm)
6. Backing: Recycled Vinyl Cushioned Backing
13. Pattern and Color: As indicated in Materials Legend. Coordinate with Architect in Field.
7. Adhesive: Forbo FRT 950 Adhesive 8. Sanitized® Treatment

## **2.03 ENTRANCE FLOORING SYSTEM**

### **A. Entrance Flooring, FL-7**

1. Products:
  - a. Marmoleum Coral Classic Tile; Fobo Flooring, Inc. (800) 842-7839
2. Description:
3. Thickness: Approx. 9mm
4. Pile Material: 1--% Polyamid-BCF solution dyed
5. Tuft Base: Non-woven polyester
6. Backing: EVERFORT vinyl by Forbo Flooring, Inc.

## **2.04 RESILIENT WALL BASE**

### **A. Resilient Base, RB-1: ASTM F 1861.**

1. Manufacturer: Johnsonite.
2. Material Requirement: Type TP (rubber, thermoplastic).
3. Manufacturing Method: Group I (solid, homogeneous).
4. Style: Cove (base with toe).
5. Minimum Thickness: 0.125 inch.
6. Height: 4 inches.
7. Lengths: Coils in manufacturer's standard length.
8. Outside Corners: Job formed.
9. Inside Corners: Job formed.
10. Color: As indicated by manufacturer's designation shown in Materials Legend.

## **2.05 RESILIENT FLORING ACCESSORIES**

- ### **A. Aluminum Transition Strip: Extruded aluminum floor plate tread with fluted surface, one square edge and one edge beveled, mill finish aluminum, 1/4 inch thick by 4 inches by one piece length full width of opening. Drill to receive flat head screws located 3 inches from each end, and uniformly spaced between at not more than 16 inches on center. Provide stainless steel machine screws and expansion shields.**
1. Product: Pemko 192A x one edge beveled.

**2.06 INSTALLATION MATERIALS**

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
  - 1. Product: Ardex; Forti Feather Finish.
- B. Adhesives: Premium grade, water-resistant type recommended by manufacturer to suit flooring, base and substrate conditions indicated.
  - 1. Products: Provide the following products:
    - a. Linoleum and Resilient Flooring Tile: See above.
    - b. Rubber Base: Johnsonite Adhesive S-725.

**PART 3 - EXECUTION****3.01 EXAMINATION**

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with installation of floor tile.
- C. Verify existing substrates comply with manufacturers requirements for adhesion and moisture requirements.
- D. Concrete Substrates: ASTM F 710, manufacturers requirements for adhesion and moisture requirements, and the following:
  - 1. Verify that substrates are 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 flooring manufacturer.
    - a. An independent testing agency shall perform alkalinity and adhesion tests and relative humidity test.
      - 1) Perform relative humidity tests on slabs on ground to receive new flooring installation at rate of 1 test/1000 sq. ft. of floor area.
      - 2) Maintain a minimum temperature of 70 deg F in spaces to be tested for not less than 72 hours prior to and during tests.
      - 3) Perform alkalinity and adhesion tests on all slabs.
    - b. Alkalinity and Adhesion Testing: Shall result in pH range recommended by flooring manufacturer when subfloor is wetted with potable water and pHydration paper is applied. Perform pH tests on concrete floors regardless of age or grade level.
    - c. Concrete substrates with pH readings less than 7.0 or above 10.0 will require remediation prior to installation.
    - d. Relative Humidity Test: Perform test using in situ probes, ASTM F 2170.
  - 2. Proceed with installation, with relative humidity level measurements as referenced below, and a pH range between 7 and 9, or greater if permitted by the flooring manufacturer, and manufacturer's requirements for alkalinity and adhesion are met.
  - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits of any kind.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.02 PREPARATION**

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion

of resilient products.

B. Existing Floor Slabs:

1. Shot blast floor to completely remove existing adhesive down to clean bare concrete and to profile surface as required by moisture vapor reduction system manufacturer.
  - a. If the RH of the slab is 90% or less, prepare slab surface in accordance with the elevated slab requirements below.

C. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions.

D. Do not install resilient flooring until it is same temperature as space where it is to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.03 RESILIENT FLOORING INSTALLATION, GENERAL

- A. Install in accordance with manufacturer's written instructions and requirements of this Section.
- B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- C. Extend flooring into toe spaces, door reveals, closets, and similar openings. Extend flooring to center of door openings.

### 3.04 SHEET FLOORING INSTALLATION

- A. Comply with manufacturer's written instructions for installing sheeting flooring and/or floor tile.
- B. Measure the area to be installed and determine the direction in which the material will be installed and seam placement. Seams must be a minimum of 6" away from underlayment and concrete joints, saw cuts, etc. Cut the required length for the first sheet, adding 3" - 6" for trimming. Fit the first sheet along the main wall and at the ends using standard fitting methods. The factory edge must be trimmed in order to produce a clean edge suitable for seaming. Immediately after installation, roll the tile with a 100 pound three-section roller in both directions and repeat as necessary to ensure adequate transfer of adhesive to the backing. Repeat the same procedure on the other half of the sheet. DO NOT REVERSE THE SHEETS. INSTALL ALL LINOLEUM SHEETS IN THE SAME DIRECTION.
- C. Adhesive Flooring Installation: Use trowel recommended by flooring manufacturer for specific adhesive (1/16" x 1/16" x 1/16" Square notch trowel). Spread rate is approximately 125 ft<sup>2</sup>/gallon.
- D. Seaming: After the material has been laid into the adhesive, the material should be trimmed to produce a net fit at the seam. The seam edges should just meet, with no pressure or fullness and should be cut with a slight bevel. This will compensate for any slight expansion that may occur.
- E. Installation Techniques:
1. Where demountable partitions and other items are indicated for installation on top of finished flooring, install flooring before these items are installed.



2. Scribe, cut, fit flooring to butt tightly to vertical surfaces, permanent fixtures and built-in furniture, including pipes, outlets, edgings, thresholds, nosings, and cabinets.
3. Extend flooring into toe spaces, door reveals, closets, and similar openings.
4. Install flooring on covers for telephone and electrical ducts, and similar items occurring within finish floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers.
5. Do not install resilient flooring over expansion joints. Use expansion joint covers manufactured for use with resilient flooring. Refer to other specification sections for expansion joint covers.
6. Adhere resilient flooring to substrate without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed installation.
  - a. Use adhesive applied to substrate in compliance with manufacturer's recommendations, including those for mixing, trowel notch, and adhesive open and working times.
7. Roll resilient flooring as required by resilient flooring manufacturer.

### **3.05 RESILIENT BASE INSTALLATION**

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required. Provide on fronts and exposed sides and backs of floor-mounted casework. Where toe space is less than base height, cut down base to proper height.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners: Provide job-formed corners everywhere, except as noted, as follows:
  1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
  2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.
  3. Adhere base to substrate with contact adhesive 12 inches each side of outside corner to properly hold base in permanent proper position in tight contact with wall. Base shall run continuous around corners with butt joints 12 inches minimum for corner.

### **3.06 CLEANING AND PROTECTION**

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient floorings and accessories.
- B. Perform the following operations immediately after completing flooring installation:
  1. Remove adhesive and other blemishes from exposed surfaces using

- cleaner recommended by resilient floor covering manufacturers.
- 2. Sweep and vacuum surfaces thoroughly.
- 3. Damp-mop surfaces to remove marks and soil.
  - a. Do not wash surfaces until after time period recommended by manufacturer.
- C. Protect flooring products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
- D. Cover resilient flooring with undyed, untreated building paper until Substantial Completion.
  - 1. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

**END OF SECTION**

**SECTION 09 90 00  
PAINTING AND COATING**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.02 SUMMARY**

- A. This Section includes the following: finish all interior surfaces exposed to view, unless fully factory-finished.
1. Mechanical and Electrical:
    - a. In finished areas, paint all 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. On the roof and outdoors, paint all equipment that is exposed to weather or to view, exception that which is factory-finished.
- B. Do Not Paint or Finish the Following Items:
1. Items fully factory-finished unless specifically so 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. Roofing and flashing.
  6. Floors, unless specifically so indicated.
  7. Ceramic and other tiles.
  8. Glass.
  9. Acoustical materials, unless specifically so indicated.
  10. Concealed pipes, ducts, and conduits.
- C. Related Sections include the following:
1. Division 02 Section "Selective Demolition and Alterations" for additional requirements regarding lead paint.
  2. Division 08 Section "Hollow Metal Frames" for factory priming steel frames.
  3. Division 08 Section "Exterior Stile and Rail Wood Doors and Windows" for factory primed, custom wood doors and storefront.
  4. Division 09 Section "Gypsum Board Assemblies" for surface preparation of new gypsum board.
  5. Review all sections for shop primed items requiring field painting.

**1.03 DEFINITIONS**

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
  2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
  3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
  4. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70

- when measured at a 60-degree meter.
5. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

#### **1.04 SUBMITTALS**

- A. General: Submit in accordance with Division 01 Section "General Requirements."
- B. Product Data: For each paint system indicated, including block fillers and primers.
  1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
  2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
  3. Include printed statement of VOC content for each product.
  4. Drawdown Cards of all paints used.
- C. Schedule: Provide schedule of all surfaces to be coated, with prime and finish coat material listed, and manufacturer's recommended wet film thickness.
- D. Color Mix Code: Paint formulas, including paint base used, for all colors used for Project.

#### **1.05 QUALITY ASSURANCE**

- A. Applicator Qualifications: Engage an experienced Applicator who has completed painting system applications similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers, primers and undercoat materials for each coating system from the same manufacturer as the finish coats.
- C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Duplicate finish of approved sample Submittals.
  1. Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted.
    - a. Wall Surfaces: Provide samples of at least 100 sq. ft.
    - b. Small Areas and Items: Architect will designate items or areas required.
  2. After permanent lighting and other environmental services have been activated, apply benchmark samples, according to requirements for the completed Work. Provide required sheen, color, and texture on each surface.
    - a. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.
  3. Final approval of colors will be from benchmark samples.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
  1. Product name or title of material.
  2. Product description (generic classification or binder type).
  3. Manufacturer's stock number and date of manufacture.
  4. Contents by volume, for pigment and vehicle constituents.
  5. Thinning instructions.

6. Application instructions.
  7. Color name and number.
  8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
1. Protect from freezing. Keep storage area neat and orderly.
  2. Remove oily rags and waste daily.
  3. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

#### **1.07 PROJECT CONDITIONS**

- A. Apply paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.
- B. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.
  2. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing coating operation.

#### **1.08 EXTRA MATERIALS**

- A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
1. Quantity: Furnish Owner with not less than 1 gal., of each material and color applied for Owner's use during move in.

### **PART 2 - PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 3 articles:
1. Basis of Design: Sherwin-Williams Co. (S-W).
  2. Acceptable Manufacturers:
    - a. Benjamn Moore & Co.
    - b. PPG Architectural Finishes, Inc.

#### **2.02 COATINGS MATERIALS, GENERAL**

- A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best quality coating material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not

be acceptable.

1. Where schedule says no substitution, use proprietary product only. Do not propose substitution, as the products from the other manufacturers have been considered, and are not acceptable.
- C. VOC Compliance for Exterior and Interior Paints and Coatings: Provide the manufacturer's formulation for the products specified below that are VOC compliant when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and having the following VOC limits expressed in grams per liter:
1. Flat Paints and Coatings: VOC content of not more than 50 g/L.
  2. Non-Flat Paints and Coatings: VOC content of not more than 150 g/L.
  3. Non-Flat Paints and Coatings - High Gloss: VOC content of not more than 250 g/L.
  4. Anticorrosive (Rust Preventative) Coatings: VOC content of not more than 400 g/L.
  5. Clear Wood Coatings:
    - a. Varnishes: VOC content of not more than 350 g/L.
  6. Quick-Dry Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
  7. Specialty Primers, Sealers, and Undercoaters: VOC content of not more than 350 g/L.
  8. Stains: VOC content of not more than 250 g/L.
- D. Colors: Provide color selections made by the Architect.

### **PART 3 - EXECUTION**

#### **3.01 EXAMINATION**

- A. Lead Paint: Materials coated with lead paint and primer will be encountered in the Work.
1. Consider all interior and exterior trim, door frames, window frames and sash to be coated with paint containing lead within the paint layers. Perform lead check swab or hand held lead paint analyzer of surfaces before abrading surfaces for paint preparation.
- B. Examine substrates, areas, and conditions, with Applicator and drywall subcontractor present, under which painting will be performed for compliance with paint application requirements.
1. Inspect new walls for dents and imperfections prior to painting. Inspect existing walls for dents, holes, damage, blemishes and imperfections prior to painting. Inspect walls again after primer and first coat of paint applied, with Applicator and drywall subcontractor present. Drywall subcontractor shall touch-up their respective work as follows:
    - a. Touch-up visible gypsum board imperfections before priming of walls.
    - b. Touch-up imperfections found in field of gypsum boards and joints made visible from painting after first finish coat applied.
  2. If unacceptable conditions are encountered, prepare written report, endorsed by Applicator, listing conditions detrimental to performance of work.
  3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  4. Application of coating indicates Applicator's acceptance of surfaces and conditions within a particular area.
  5. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
- C. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of specified finish materials to ensure use of compatible primers.
1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

### 3.02 PREPARATION

1. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
  1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
  1. See Section 024119 - Selective Demolition and Alterations for lead paint information.
  2. Provide barrier coats over incompatible primers and coatings or remove and reprime.
  3. Existing Surfaces, Opaque Finishes: Prepare existing surfaces as follows:
    - a. Thoroughly clean existing surfaces to be recoated to remove dust, dirt, grease, oils, and other surface contaminants that would affect the proper adhesion of the new coatings.
    - b. Prior to sanding, test existing coatings for lead.
    - c. Scrape loose paint from surfaces indicated to be recoated. Sand edges of remaining paint to smooth out surface.
    - d. Existing painted surfaces shall be sanded to fully dull the surface. Perform bond tests on existing painted surface to verify bond before proceeding with paint application.
    - e. On glossy surfaces, glazed surfaces, and tile like surfaces, apply a bonding primer specifically formulated for hard gloss surfaces.
  4. Existing Concrete Masonry Units: Clean previous coated concrete masonry units to remove dust, dirt, grease, oils and other contaminants detrimental to formation of a durable paint film.
  5. Wood, New: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
    - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
    - b. If transparent finish is required, backprime with spar varnish.
  6. Ferrous Metals, New: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
    - a. Touch up bare areas and shop-applied prime coats that have been damaged. Clean with solvents recommended by paint manufacturer and SSPC SP2; and touch up with same primer as the shop coat.
- D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
  1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
  2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface

- film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

### 3.03 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
  1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
  2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
  3. Provide finish coats that are compatible with primers used and existing coatings.
  4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
  5. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
  6. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
  7. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces, unless indicated otherwise.
  8. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
  1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
  2. Omit primer over metal surfaces that have been shop primed and touchup painted, unless otherwise indicated.
  3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
  4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.
- C. Paint all exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
  1. Painting includes field painting of exposed bare and covered pipes and ducts (including color-coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment at all locations except mechanical and electrical rooms.
- D. Doors:
  1. Coat all edges and ends of interior and exterior doors receiving paint or transparent finish.



- E. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
  - 1. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- F. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions. Walls shall have roller finish.
  - 1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
  - 2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
- G. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness per coat indicated. Dry film thicknesses listed in paint schedules are minimum thickness per coat.
- H. Mechanical and Electrical Work: Painting of mechanical, plumbing, fire protection, and electrical work is limited to items exposed in occupied spaces (outside mechanical and electrical rooms).
- I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- K. Transparent (Clear or Stained) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
  - 1. Provide satin finish for final coats, unless otherwise noted.
- L. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.
- M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.
- N. Exterior Ferrous Metal Items to Be Painted Include, but Are Not Limited To, the Following (Existing):
  - 1. Metal railing.
- O. Interior Ferrous Metal Items to Be Painted Include, but Are Not Limited To, the Following:
  - 1. Metal door frames.
  - 2. Existing painted piping and conduit.
  - 3. Access panels (both sides).
  - 4. Miscellaneous metal items.

### **3.04 CLEANING**

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the Project site.
  - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

### **3.05 PROTECTION**

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
  - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### **3.06 EXTERIOR PAINT SCHEDULE**

- A. VOC Compliance, General: Provide the manufacturers' formulations for the products specified below that comply with the VOC requirements 2.2.C of this Section.
- B. Ferrous Metal, Existing Metal Railings: Provide the following finish systems over exterior ferrous metal.
  - 1. Low-Luster Acrylic Finish: 2 finish coats over a bonding primer.
    - a. Bonding Primer: Low-odor, low VOC, exterior barrier coat applied at spreading rate recommended by the manufacturer to achieve a dry film thickness of not less than indicated for product.
      - 1) Extreme Bond Interior/Exterior Primer B51W00150 Series; 0.9 mils DFT.
    - b. First and Second Coat: Low-sheen (satin), exterior, acrylic-latex paint applied at spreading rate recommended by the manufacturer to achieve a dry film thickness per coat of not less than indicated for product.
      - 1) S-W: Duration Exterior Acrylic Satin K33-200 Series; 2.4 mils DFT per coat.

### **3.07 INTERIOR COATINGS SCHEDULE**

- A. VOC Compliance, General: Provide the manufacturers' formulations for the products specified below that comply with the VOC requirements in paragraph 2.2.C of this Section.
- B. Gypsum Board and Plaster, New and Existing: Provide the following finish systems over interior gypsum board and plaster surfaces:
  - 1. Flat Acrylic Finish, GPDW Ceilings and Soffits: 2 finish coats.
    - a. Primer, New and Patched Areas: Low-odor, zero VOC, latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a dry film thickness of not less than indicated for product.
      - 1) S-W: ProMar 200 Low Zero VOC Interior Latex Primer B28W02600 Series; 1.0 mils DFT.
    - b. First and Second Coats: Low-odor, zero VOC, flat, acrylic-latex-based, interior paint applied at spreading rate recommended by the manufacturer to achieve a dry film thickness per coat of not less than indicated for product.
      - 1) S-W: ProMar 200 Zero ProGreen 200 Low VOC Interior Latex Flat, B30-2600 Series; 1.6 mils DFT per coat.
  - 2. Semi-Gloss Acrylic Finish, Walls: 2 finish coats over a primer. (Verify Sheen with

Owner)

- a. Primer, New Surfaces, Patched Areas and Bare Spots in Existing Coatings: Low-odor, zero VOC, latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a dry film thickness of not less than indicated for product.
    - 1) S-W: ProMar 200 Zero VOC Interior Latex Primer B28W02600 Series; 1.5 mils DFT.
  - b. If existing painted surfaces are glossy, dull surface and apply a bonding primer.
    - 1) S-W: Extreme Bond Interior/Exterior Primer B51W00150 Series; 0.9 mils DFT.
  - c. First and Second Coats: Semigloss, vinyl acrylic, interior latex applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product. Confirm gloss level with Owner prior to ordering material.
    - 1) S-W: ProMar 200 Zero VOC Interior Latex Semi-Gloss B31-2600 Series; 1.6 mils DFT per coat.
- C. Woodwork, New Interior: Provide the following natural finishes over new, interior woodwork:
1. Waterborne, Satin-Polyurethane Finish: 3 finish coats of a waterborne, clear-satin varnish.
    - a. Stain Coat, at Locations Required by Architect: VOC compliant, alkyd-based, penetrating, interior wood stain applied at spreading rate recommended by the manufacturer. Stain color as selected by Architect from the manufacturer's full range of options.
      - 1) S-W: Wood Classics Interior Wood Oil Stain, A49-200 Series.
    - b. First, Second and Third Finish Coats: Waterborne, varnish finish applied at spreading rate recommended by the manufacturer.
      - 1) S-W: Minwax Polycrylic.
- D. Woodwork, New Exterior: Provide the following natural finishes over exterior woodwork:
1. Stain Coat, at Locations Required by Architect: VOC compliant, alkyd-based, penetrating, exterior wood stain applied at spreading rate recommended by the manufacturer.
    - a. Duckback SuperDeck: Semi-Transparent Stain Oil-Based (2100-2300) or similar.
    - b. Color: As selected by Architect from the manufacturer's full range of options.
    - c.
- E. Stained Doors, New and Existing: Provide the following stained finishes over properly prepared interior woodwork and trim as specified in Article 3.2.C.3 above. Test sample area in an inconspicuous area prior to commencement of coating application to confirm compatibility with existing coatings. Review test area with Architect.
1. Systems:
    - a. Satin Varnish Finish, Existing: 1 finish coat of an oil based varnish.
    - b. Satin Varnish Finish, New to Match Existing: 3 finish coats of an oil based varnish over semitransparent stain coat. Stain coat shall match stain on existing woodwork and trim.
  2. Products:
    - a. Stain Coat: VOC compliant, penetrating, interior wood stain, applied at spreading rate recommended by the manufacturer.
      - 1) S-W: Wood Classics Interior Wood Oil Stain, A49-200 Series.
    - b. First, Second and Third Finish Coats: Fast drying oil/alkyd varnish finish applied at spreading rate recommended by the manufacturer.

- 1) S-W: Wood Classics FastDry Oil Varnish, A66-300 Series.
- F. Ferrous Metal, New and Existing, Including New and Existing H.M. Doors and Frames: Provide the following finish systems over ferrous metal. Primer is not required on existing and shop-primed items, except steel door frames, which require a primer under this specification.
1. Semigloss, Waterborne Acrylic Based Alkyd Enamel Finish, All Surfaces: 2 finish coats over a primer.
    - a. Primer, New and Bare Spots of Existing: Quick-drying, corrosion resistant, waterborne acrylic primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
      - 1) S-W: DTM Acrylic Primer/Finish, B66W1; 3.0 mils DFT.
    - b. Bonding Primer, Existing: Low-odor, low VOC, interior latex primer applied at spreading rate recommended by the manufacturer to achieve a dry film thickness of not less than indicated for product.
      - 1) S-W: Extreme Bond Interior/Exterior Primer B51W00150 Series; 0.9 mils DFT.
    - c. First and Second Coats: Semigloss, single component, waterborne acrylic-coating applied at spreading rate recommended by the manufacturer to achieve a dry film thickness per coat of not less than indicated for product.
      - 1) S-W: DTM Acrylic Coating Finish, B66W00211; 1.5 mils DFT per coat.
- G. Concrete Masonry Units, New and Existing: Provide the following finish systems over existing interior concrete masonry block units:
1. Semi-Gloss, Acrylic-Enamel Finish: 2 finish coats over block filler.
    - a. Block Filler (New CMU and Bare Spots in Existing Coating for CMU): Latex-based, block filler applied at spreading rate recommended by the manufacturer to achieve a dry film thickness of not less than indicated for product.
      - 1) S-W: PrepRite Interior/Exterior Block Filler B25W25; 8 mils DFT.
    - b. If existing painted surfaces are glossy, dull surface and apply a bonding primer.
      - 1) S-W: Multi-Purpose B51-450.
    - c. First and Second Coat: Semi-Gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a dry film thickness per coat of not less than indicated for product. Confirm gloss level with Pwerner prior to ordering material.
      - 1) S-W: ProMar 200 Zero VOC Interior Latex Semi-Gloss B31-2600 Series; 1.6 mils DFT per coat.

**END OF SECTION**

**SECTION 10 14 24  
INTERIOR SIGNAGE****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Interior ADA compliant signage.

**1.02 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's descriptive literature.
- C. Shop Drawings:
  - 1. Interior Signs: Submit shop drawings showing to scale all sign types including lettering, layout and dimensions.
  - 2. Sign Schedule: Submit a sign schedule with all signs listed by door number location. Sign schedule shall include sign type, side of wall for mounting by room number, and sign text.
- D. Samples:
  - 1. Selection Samples: Submit complete set of plastic color chips representing manufacturer's full range of available colors.

**1.03 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with requirements of ANSI/ICC A117.1 and ADAAG.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Inspect products upon receipt. Store products in manufacturer's packaging until ready for installation.

**PART 2 PRODUCTS****2.01 MANUFACTURERS**

- A. ADA Signs Basis of Design: HC300 ADA System by Best Sign Systems.
- B. Substitutions: See Section 01 60 00 - Product Requirements.

**2.02 INTERIOR SIGNS**

- A. ADA-Compliant Interior Signage with Raised Borders:
  - 1. Type: Four-in one construction with raised borders; three-ply melamine plastic laminate with phenolic core signs, with lettering and symbols raised 1/32 inch from sign plate face; and 3/8 inch wide, 1/32 inch raised perimeter border with 1/8 inch inside radius.
  - 2. Sign Thickness: 1/8 inch thick or 1/4 inch thick as required.
  - 3. Construction: One-piece; added-on or engraved characters not acceptable.
  - 4. Lettering Style: Helvetica Medium, upper case.
  - 5. Braille: Grade 2 Braille, placed directly below last line of letters or numbers.
  - 6. Performance: Non-static, fire-retardant, and self-extinguishing.
  - 7. Contrast: Letters numbers and symbols shall contrast with background.
  - 8. Corners: Outside radius, 1/2 inch.
  - 9. Color of Plastic: As selected from manufacturer's standard colors.
  - 10. Finish of Plastic: Matte.
  - 11. Color of Background: As selected from manufacturer's standard paint colors.
  - 12. Sign Margins: Letters and numbers centered on sign with 1/2 inch side margins and 3/8 inch top/bottom margins.
  - 13. Sign Sizes:
    - a. Restroom and symbol signs, 8 by 8 inches.
    - b. Room identification signs, 9-1/2 by 4-3/4 inches.
    - c. Room number signs, 4-3/4 by 4-3/4 inches.
    - d. Exit signs, 8 by 4 inches.

- B. Sign Types: Numbers and text may change at a later date, but the Contractor's bid shall be based on the following:
  - 1. Room Number Signs: One sign with room number for every door scheduled on the Door Schedule. (Exception: Toilet Rooms).
  - 2. Toilet Room Signs: Instead of room number text, all toilet rooms shall be identified as "Restroom".
    - a. Accessible toilet room signs shall include an International Symbol of Access.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine installation areas to ensure that conditions are suitable for installation.
- B. Examine signage for defects prior to installation. Do not install damaged signage.

#### **3.02 PREPARATION**

- A. Verify mounting heights and locations for signage comply with referenced standards.
- B. Clean mounting locations of dirt, dust, grease or similar conditions that would prevent proper installation.

#### **3.03 SIGNAGE INSTALLATION**

- A. Install signs level, plumb, without distortion, and in proper relationship with adjacent surfaces using manufacturer's recommended standard mounting system.
  - 1. Mount signs with taper-resistant screws, minimum 4 per sign. All signs over ten inches in length shall be furnished with additional intermediate screws (top and bottom).
  - 2. Mount signs with double-sided foam tape to smooth, non-porous surfaces. On cork surfaces, screw fastens same color and size backer plate through cork surface into wall. Use foam-tape over backer sign plate to mount room sign.
  - 3. Mount signs at cork surfaces with color matching screws and backer plate to match sign size. Use double-sided foam tape to secure sign to backer plate.
  - 4. Mount signs on glass with double-sided foam tape and provide matching sized blank sign panel for back side of glass.
- B. Mounting Height and Locations:
  - 1. Mounting locations shall be as determined by the Architect.
  - 2. In general, signs shall be mounted at 60" above the floor to the base line of the upper line of text. This is a maximum limit and shall not be exceeded.
    - a. For locations where this cannot be done, the acceptable mounting height range is at least 48" above the floor to the base line of the lowest line of text to a maximum of 60" above the floor to the base line of the upper line of text.
  - 3. For door signs, mounting shall be within 18" laterally of the door latch jamb. Signs shall not be located so as to be obscured by doors in the open position.
  - 4. Signs shall be located so that a person can approach a sign within three (3") inches without encountering obstacles or standing within the swing of the door.
- C. Clean signs and remove adhesive from exposed sign surfaces after installation as recommended by manufacturer.
- D. Replace damaged products before Substantial Completion.

### **END OF SECTION**

**SECTION 10 21 16**  
**SOLID PLASTIC TOILET COMPARTMENTS**

**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. Solid-plastic toilet compartments configured as toilet enclosures and urinal screens.
- B. Related Requirements:
  - 1. Division 05 Section "Auxiliary Structural Support System" for supports that attach ceiling-hung compartments to overhead structural system.
  - 2. Division 06 Section "Rough Carpentry" for concealed wood blocking.
  - 3. Division 10 Section "Toilet Accessories" for toilet tissue dispensers, grab bars, and similar accessories mounted on toilet compartments.

**1.03 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.
- B. Shop Drawings: For toilet compartments.
  - 1. Include plans, elevations, sections, details, and attachment details.
  - 2. Show locations of centerlines of toilet fixtures.
  - 3. Show locations of floor drains.
  - 4. Show overhead support or bracing locations.
- C. Samples: Submit 6-inch square samples of same thickness and material indicated for manufacturer's complete range of color and pattern options.

**1.04 PROJECT CONDITIONS**

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication and indicate measurements on Shop Drawings.

**PART 2 - PRODUCTS****2.01 PERFORMANCE REQUIREMENTS**

- A. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

**2.02 SOLID-PLASTIC TOILET COMPARTMENTS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
  - 1. Basis of Design: Scranton Products
  - 2. Acceptable Manufacturers:
    - a. Global Steel Products Corp.
    - b. Hadrian Manufacturing Inc.
- B. Toilet-Enclosure Style: Floor Mounted. 55" Height
- C. Urinal-Screen Style: Wall hung.
- D. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) or polypropylene (PP) panel material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.
  - 1. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum or stainless-steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
  - 2. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range.
- E. Pilaster Sleeves (Caps): Manufacturer's standard design; stainless steel.
- F. Brackets (Fittings):
  - 1. Full-Height (Continuous) Type: Manufacturer's heavy-duty design; stainless steel.
- G. Overhead Cross Bracing for Floor Mounted Units: As recommended by manufacturer and fabricated from solid polymer.

## **2.03 HARDWARE AND ACCESSORIES**

- A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.
  - 1. Hinges: Manufacturer's continuous stainless-steel hinge or extruded aluminum wrap-around hinge. Mount with through-bolts.
  - 2. Latch and Keeper: Manufacturer's heavy-duty surface-mounted cast-stainless-steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
  - 3. Coat Hook: Surface mounted hook with concealed fasteners and projecting 2 inches or less; satin stainless steel finish; Bobrick Washroom Equipment, Inc.; Model B-6717.
    - a. Install hook at ADA mounting height as indicated on the drawings in ADA stalls, typ.



4. Door Pull: Manufacturer's heavy-duty cast-stainless-steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.

- B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

## **2.04 MATERIALS**

- A. Aluminum Castings: ASTM B 26/B 26M.
- B. Aluminum Extrusions: ASTM B 221.
- C. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- D. Stainless-Steel Castings: ASTM A 743/A 743M.

## **2.05 FABRICATION**

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Ceiling-Hung Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage.
- C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32- inch-wide, clear opening for compartments designated as accessible.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
  - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.02 INSTALLATION**

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
  - 1. Maximum Clearances:
    - a. Pilasters and Panels: 1/2 inch.
    - b. Panels and Walls: 1 inch.
  - 2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
    - a. Align brackets at pilasters with brackets at walls.
- B. Ceiling-Hung Units: Secure pilasters to supporting structure and level, plumb, and tighten. Hang doors and adjust so bottoms of doors are level with bottoms of pilasters when doors are in closed position.
- C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

**3.03 ADJUSTING**

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

**END OF SECTION**

**SECTION 10 28 00  
TOILET ACCESSORIES**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.02 SUMMARY**

- A. This Section includes the following:
  - 1. Toilet accessories.
  - 2. Installation of toilet accessories.
- B. Related Sections include the following:
  - 1. Division 06 Section "Rough Carpentry" for concealed wood blocking to support accessories.
  - 2. Division 08 Section "Mirrors" for frameless mirrors.

**1.03 SUBMITTALS**

- A. General: Submit in accordance with Division 01 Section "General Requirements."
- B. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.
- C. Shop Drawings: Include blocking locations and mounting heights identified.
- D. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use room and accessory designations indicated in the Toilet Accessory Schedule in Part 3 and room and accessory designations indicated on Drawings.

**1.04 QUALITY ASSURANCE**

- A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.
- B. Insofar as possible, fitting, construction and fabrication of the work shall be executed at shop, ready for delivery and erection at building.
- C. Provide all holes, connections, and fastenings for and to work of other trades abutting, adjoining or intersecting work of this Section.

**1.05 COORDINATION**

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.
- C. Galvanized Steel Sheet: ASTM A 653/A 653M, G60.
- D. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.
- E. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.
- G. Epoxy Anchors: Red Head Umbrella Anchor, Model HBU-38, size as required for fasteners.

### **2.02 TOILET ACCESSORIES**

- A. Toilet Tissue Dispenser: Surface Mounted Multi-Roll
  - 1. Bobrick B-2888, stainless steel, satin finish, 22-gauge
- B. Sanitary Napkin Disposal: Surface Mounted
  - 1. Bobrick B-5270 Matrix Series, ABS Plastic, grey color.
- C. Paper Towel Dispenser and Waste Receptacle: Surface mounted
  - 1. Bobrick B-542, Classic Series heavy gauge stainless steel, satin finish, welded construction. Provide Liner Mate, Bobrick 3944-134, typ.
- D. Hook: Surface-Mounted
  - 1. Bobrick B-677 "towel pin", stainless steel satin finish
  - 2. Provide in 24" lengths where indicated on the drawings. Provide 18" where 24" not feasible; verify all dimensions in field.
- E. Baby Changing Station: Horizontal Wall Mounted
  - 1. Koala Kare KB11-SSWM, Stainless Steel Finish
- F. Grab Bars: Provide stainless-steel grab bar, concealed mounting with manufacturer's standard flanges and anchors, minimum nominal thickness 0.05 inch, 1-1/2 inches outside diameter for heavy-duty applications, in lengths and configurations indicated.
  - 1. Product: Bobrick Washroom Equipment, Inc.; B-6806.99 Series.

**2.03 FABRICATION**

- A. General: One, maximum 1-1/2-inch- diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of accessories. On interior surface not exposed to view or back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.
- B. Sections and shapes shall be rolled, formed, drawn, or extruded as required for respective functions.
- C. Fastenings, exposed metal fastenings, and accessories, unless Underwriters prohibit for safety, shall be of same materials, texture, color and finish as the base metal to which applied.
- D. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

**PART 3 - EXECUTION****3.01 INSTALLATION**

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.
- C. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.
- D. Install all items in accordance with manufacturer's instruction and as located on Drawings.

**3.02 TOILET ACCESSORIES SCHEDULE**

- A. Toilet Accessories in Single Person Toilet Rooms:
  - 1. Install one paper towel dispenser and waste receptacle.
  - 2. Install one toilet tissue dispenser.
  - 3. Install one baby changing station.
  - 4. Provide grab bars in configurations shown as indicated; screwed to solid wood blocking in stud partitions.
- B. Toilet Accessories in Multi-Person Toilet Rooms:
  - 1. Install one toilet tissue dispenser for each water closet.
  - 2. Install paper towel dispensers and waste receptacle where indicated.
  - 3. Install one sanitary napkin disposal at each Women's water closet.
  - 4. Install grab bars in configurations shown at designated water closets screwed; to solid wood blocking in stud partitions.
- C. Toilet Accessories in Shower Rooms:
  - 1. Install two surface mounted hooks, typ.; mounting heights as per the drawings.

**3.03 ADJUSTING AND CLEANING**

- A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

**END OF SECTION**

**SECTION 10 85 00  
BUILDING SPECIALTIES**

**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. Felt Wall Panels
  - 2. Gas Fireplace Insert
  - 3. Factory Fabricated Visual Display Board
- B. Related Sections Include the following:
  - 1. Division 09 Section "Gypsum Board Assemblies" for steel framing.

**1.03 SUBMITTALS**

- A. General: Submit in accordance with Division 01 Section "General Requirements."
- B. Product Data: For each type of product indicated.
- C. Samples for Initial Selection:
  - 1. Felt Panels: Actual pieces of specified colors of all felt materials.
- D. Install resilient flooring after other finishing operations, including painting, have been completed.

**1.04 WORKMANSHIP**

- A. Materials, devices, equipment and apparatus of a patented or of a special nature of manufacture shall be prepared, applied, or installed in strict accordance with the manufacturer's directions.
- B. Work of this Section shall be executed in strict accordance with Drawings and approved Shop Drawings.

**PART 2 - PRODUCTS**

**2.01 FELT WALL PANELING**

- A. Felt Wall Paneling: Index Dimensional tile-based wall covering by FilzFelt (filzfelt.com).
  - 1. Felt: 3mm and 5mm – pattern Index Dimensional
  - 2. Content: 100% Wood Design Felt Face and Cork Composite Backing
  - 3. Thickness: 1/4-5/16 inch
  - 4. Tile Size: 2'-0" x 6"
  - 5. Color: 1 color as selected by Architect from Manufacturer's full range
  - 6. Trim: End-of-run Trim at all exposed edges (not required at corner terminations)
  - 7. Pattern: Equal mix of Elements A through D; coordinate with Architect.

**2.02 GAS FIREPLACE**

- A. Gas Fireplace: Regency Horizon Large Contemporary Gas Fireplace by Regency Fireplace Products
  - 1. Model: HZ40E-NG10

2. Finish: Black
  3. Frame: Clean Face Option
  4. Size: 56 11/16" x 25 1/8" (metal faceplate)
  5. Firebed: Volcanic Stones – Gray
  6. Remote Control: Proflame GTMF
  7. Wall Mounted On/Off Switch: Standard
  8. Thermostat: Wall Mounted.
  9. Venting: direct Vent 4" rigid or flex
  10. Safety Screen: manufacturer's standard
- B. Rigid Pipe Venting System: Simpson Direct Vent Pro, vertical termination

## **2.03 FACTORY-FABRICATED VISUAL DISPLAY BOARDS AND ASSEMBLIES**

- A. Wall Mounted Bulletin Board Cabinet: heavy duty aluminum trim with 2" internal depth.
1. Color: Anodized.
  2. Basis-of-Design: Subject to compliance with requirements, provide Deluxe Bulletin Board Cabinet by MooreCo; Vanerum North America.
    - a. Size: 48" x 72"
    - b. Model: 95SAG
    - c. Interior Finish: Fabric as selected by Architect from Manufacturer's full range.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Examine All Items specified under this Section shall be installed in strict accordance with manufacturer's recommendations and approved Shop Drawings.

### **3.02 FELT WALL PANELS**

- A. Install panels in accordance with manufacturer's instructions for designated pattern (Standard Configuration).
- B. Confirm pattern on site with architect prior to installation.
- C. Each order includes equal numbers of four pattern elements with alternation strips of 3m and 5mm felt to achieve a dimensional effect. Tiles are to be arranged according to one standard configuration.
- D. Attach to wall surface using heavy-duty wall-covering adhesive as recommended by the felt manufacturer.
- E. Tiles may be trimmed to size with a utility knife.

### **3.03 GAS FIREPLACE**

- A. Install fireplace in strict accordance with manufacturer's instructions.
1. Provide Framing as specified in manufacturer's instructions "Framing" section.
- B. Provide Vertical Venting Arrangement for Vertical Termination with rigid pipe venting system as provided by manufacturer.
1. Vent must be supported at offsets
  2. Minimum distance between elbows is 1 foot
  3. Maintain clearances to combustibles as listed in the manufacturer's instructions "Clearances" section.
  4. Provide firestopping as required at wall penetrations, if necessary.

### **3.04 FACTORY-FABRICATED VISUAL DISPLAY BOARDS AND ASSEMBLIES**



- A. General: Mount bulletin board in accordance with manufacturer's recommendations.
- B. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.
- C. Touch up factory-applied finishes to restore damaged or soiled areas. Remove and replace units that are damaged or do not comply with requirements. Units may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing as determined by Architect.
- D. Cover and protect visual display surfaces after installation and cleaning.

**END OF SECTION**

**SECTION 21 05 00  
COMMON RESULTS FOR FIRE SUPPRESSION**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

**1.02 SUMMARY**

- A. Section Includes:
  - 1. Furnish services, skilled and common labor, and apparatus and materials required for the complete installation as shown and within the intent of the drawings and/or these Specifications. Requirements of this section apply to Division 21 Sections.

**1.03 REFERENCES**

- A. The fire suppression system and accessories shall conform to the requirements of:
  - 1. NFPA 13

**1.04 SUBMITTALS**

- A. Manufacturer's installation and maintenance instructions.
- B. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
- C. Nameplate legends.
- D. Dimensions and configurations of fire suppression system and complete layout.

**1.05 QUALITY ASSURANCE**

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.
- C. Manufacturer qualifications: Firms regularly engaged in manufacture of fire suppression systems, of types and sizes required and whose products have been in satisfactory use in similar service for not less than 5 years.
- D. Installer's qualifications: Firms with at least 5 years of successful installation experience with Projects utilizing fire suppression systems similar to that required for this Project.

**1.06 COORDINATION**

- A. Coordinate all work with all other trades.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Products to be designated fire suppression design engineer.

**2.02 PERFORMANCE REQUIREMENTS**

- A. Fire suppression design engineer will designate all performance requirements of the system.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting fire suppression system.

**3.02 WORKMANSHIP AND CONTRACTOR'S QUALIFICATIONS**

- A. Only quality workmanship will be accepted. Haphazard or poor installation practice will be cause for rejection of work.
- B. Provide foreman in charge of this work at all times.

**3.03 COORDINATION**

- A. Coordinate work with other trades to avoid conflict and to provide correct rough in and connection for equipment furnished under trades that require electrical connections. Inform Contractors of other trades of the required access to and clearances.

**3.04 INSTALLATION**

- A. Follow design and layout as provided by the fire suppression engineer.
- B. Manufacturer's Directions: Follow manufacturer's directions covering points not shown on the drawings provided by the fire suppression engineer.

**END OF SECTION**

**SECTION 22 05 00  
COMMON RESULTS FOR PLUMBING**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Related Documents:
  - 1. Drawings and general provisions of the Subcontract apply to this Section.
  - 2. Review these documents for coordination with additional requirements and information that apply to work under this Section.
- B. Section Includes:
  - 1. Furnish services, skilled and common labor, and apparatus and materials required for the complete installation as shown and within the intent of the drawings and/or these Specifications.
  - 2. Requirements of this section apply to Division 22 Sections.

**1.02 REFERENCES**

- A. General:
  - 1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
  - 2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.
  - 3. Refer to Division 22 Section "Common Results for Plumbing" for codes and standards, and other general requirements.

**1.03 DESCRIPTION**

- A. These Division 22 specifications define the statutory, administrative, procedural, and technical requirements of the mechanical and controls modifications, replacements, and/or upgrades products and services to be provided on this Subcontract.
- B. Provide plumbing work as indicated on the Drawings and specified in Division 22 including:
  - 1. Prepare coordination drawings, shop drawings, submittals, as-built drawings, and operating and maintenance instructions.
  - 2. Determine items and quantities required.
  - 3. Provide complete, continuous, operational, and functioning systems.
  - 4. Fully coordinate with work of other Sections, including field verification of elevations, dimensions, clearance, and access.
  - 5. Repair of all damage done to premises as a result of this installation and removal of debris left by those engaged in this installation.
  - 6. Rigging, hoisting, transportation, and associated work necessary for placement of equipment in the final location shown.
  - 7. Disassembly and re-assembly of equipment furnished under this Section, should this be required in order to move equipment into final location shown on the Drawings.
  - 8. Labor, materials, tools, appliances and equipment that are required to furnish and install the complete installation for this section of the work including that which is reasonably inferred.
  - 9. Cooperation with other crafts in putting the installation in place at a time when space required is accessible.
  - 10. Temporary scaffolding necessary for performance of the work in this Division.
  - 11. Cutting and core drilling required for work of Division 22, including locating of rebar or

- coordination of locating rebar with the General Contractor.
12. Pipe sleeves for all holes in walls, floors, and ceilings, and cutting of floor slabs and slabs on grade.
  13. Waterproofing where necessary for installation under this Division.
  14. Cooperation with and assistance to the Facilities Monitoring and Control System Contractor as required to provide a complete and functional plumbing system.
  15. Counterflashing of roof penetrations for work of Division 22.
  16. Sizes, and locations for installation of any curbs and pads for work of Division 22.
  17. Temporary and permanent stands and supports for equipment requiring them including vibration isolation.
  18. Temporary protection of existing installation.
  19. Stenciling and equipment identification.
  20. Fire-stopping of penetrations of ducts, piping, and conduits through walls, floors, and ceiling assemblies.
  21. Temporary utilities as required to install work on Division 22 including lighting, water, gas, electricity, etc.
  22. Fees, permits, inspections, taxes, and approach from agencies that have jurisdiction over installation of Division 22.
  23. Participation in and coordination with the Commissioning process.
  24. Warranty.

#### **1.04 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical product specification sheets for each system component and device to be provided that includes data needed to prove compliance with this specification. Clearly indicate the exact model of each component to be provided.
- B. City of Portsmouth manufacturer's operation and maintenance manuals, include a list of spare parts that the manufacturer recommends the City of Portsmouth purchase.
- C. Lateral Force Anchorage: Submit lateral force anchorage calculations and details of anchorage of components to building including backing design. Seismic forces shall be in accordance with a value 1.5 used as the minimum CBC seismic importance factor, Ip. Calculations shall be sealed by a Structural Engineer registered in New Hampshire.
- D. Record Documents: Upon completion of the work covered by this Contract, as directed, furnish the City of Portsmouth with as-built drawings. Include changes installed under this Contract which are not in accordance with the Contract Drawings. Note that these as-built drawings are to be based on the Contract Drawings. In addition, submit final copies of the Shop Drawings and Coordination Drawings.

#### **1.05 QUALITY ASSURANCE**

- A. Materials and Equipment: materials and equipment shall be new. Materials and equipment for which tests have been established by Underwriter's Laboratories, Inc. shall be approved by that body and shall bear its label of approval.
  1. The first names manufacturer and product is the basis of design. Other manufacturers and/or products are considered as substitutions.
- B. In lieu of listing by an approved testing laboratory, consideration will be given to certified test reports of an adequately equipped, recognized independent test laboratory competent to perform such testing indicating conformance to requirements of the applicable Underwriter's Laboratories, Inc. standards.
- C. Unless otherwise approved by the Project Manager, the materials to be furnished under this specification shall be the standard products of manufacturers regularly engaged in the production

of such equipment equal to or superior to the material specified, and shall be the manufacturer's latest standard design that complies with the specification requirements.

**D. Approval of Materials:**

1. A complete list of materials and equipment proposed shall be submitted to the Project Manager for approval. The list shall include for each item: the manufacturer, the manufacturer's catalog number, type or class, the rating, capacity, size, etc.
2. Before installation of the equipment, the Subcontractor shall submit for approval detailed construction drawings for each item of fabricated equipment required for installation. Drawings shall be to scale and fully dimensioned and shall provide sufficient detail to clearly indicate the arrangement of equipment and its components.
3. Installation of approved substituted equipment is the Subcontractor's responsibility, and changes required to work included under other divisions for installations of approved substituted equipment must be made to the satisfaction of the City of Portsmouth and without change in contract price. Approval by the City of Portsmouth of substituted equipment and/or dimension drawings does not waive these requirements.

**1.06 START-UP TRAINING**

- A. Assist City of Portsmouth in preparing a formal training program for operating staff prior to the scheduled start-up date. The program will consist of the design, start-up, and operation of the mechanical, plumbing, fire protection, and building automation systems. Coordinate the training program with the production of the operation and maintenance manuals. Provide indexed binder and training materials to each participant.
- B. Provide 16 hours (unless specified otherwise) of on-site training in the operation and maintenance for installed system and major piece of equipment. Systems include boilers and heating hot water system, chillers and chilled water system, plumbing, fire protection, air supply and exhaust systems, air conditioning units, balancing, and Facilities Monitoring and Control System. Trainers shall be experienced, manufacturer-approved personnel.
  1. Schedule training for each system in advance with the City of Portsmouth.
  2. Include travel, per diem and incidental costs for personnel under contract to the Subcontractor.
  3. Operations and Maintenance data to be available for training sessions.

**1.07 RULES AND REGULATIONS**

- A. Provide work and materials in full accordance with the latest rules of the organizations listed in Division 22, and with prevailing rules and regulations pertaining to adequate protection and/or guarding of moving parts, or otherwise hazardous locations.
- B. Whenever the Drawings and Specifications require something which will violate the regulations, the regulations shall govern. Review the Drawings and Specifications, and request from the City of Portsmouth clarification or revision of portion of the work in violation of the rules or regulations prior to installing the work. Necessary installation alteration required for compliance shall be made at no additional cost to the City of Portsmouth.
- C. Whenever the Drawings and Specifications require larger sizes, or higher standards than are required by the regulations, the Drawings and Specifications shall govern.
- D. Strictly conform to the requirements of the National Fire Protection Association, National Electrical Code, OSHA, Fire Marshal, and insurance underwriters' requirements. expenses required shall be borne under this Contract.

**1.08 PROTECTION OF EQUIPMENT**

- A. Assume responsibility for damage to of the work or premises before substantial completion.

Should new or existing equipment become damaged, restore it to its original condition and finish before final acceptance. Damage incurred to the City of Portsmouth property or to the work of other Divisions, caused by this Division, shall be replaced or repaired by, and at the expense of, the Subcontractor to the satisfaction of the City of Portsmouth. Exposed materials shall be clean at the time of acceptance of the project.

#### **1.09 SCHEDULING AND SEQUENCING**

- A. Cooperate with other trades in putting this installation in place at a time when space required is accessible, and in such a manner that other work in this space may be installed as shown on the Drawings. Schedule work and cooperate with the others to avoid delays, interferences, and unnecessary work, conforming to the construction schedule, making the installation when and where directed.
  - 1. Include labor and materials to install certain items furnished under this contract when required by the schedule. These items are part of this contract but may need to be installed only after completion of work under another contract which this contractor may or may not be participating in. It is the responsibility of this contract to coordinate with others to insure that preparations are made and ready to accept the installation of these items. These items include, but are not limited to:
    - a. Air inlets and outlet
    - b. Temperature sensors.
    - c. Monitoring and control panels.
    - d. Sprinkler heads.
- B. If a discrepancy is discovered between engineering and architectural Drawings, whether with respect to a significant variance between location, variation in quantity, or violation of code requirements, notify Architect for clarification and do not proceed with the work affected until clarification has been made.
- C. Schedule work in advance with the City of Portsmouth. No system shall be shutdown unless approved in writing.

#### **1.10 TEMPORARY USE**

- A. Should it become necessary to use the new portion of the system and the new equipment to warm or air condition part of the building before the completion of this work, the City of Portsmouth reserves the right to make use of same at its own risk and expense, but the temporary use of the equipment shall not constitute an acceptance of the plant or part thereof in way. The City of Portsmouth will bear the cost of fuel and electrical current for such temporary use of the equipment. If temporary use of new systems or equipment is solely for the benefit of the contractor, contractor shall bear the cost of fuel and electrical current for such temporary use.

#### **1.11 WARRANTY**

- A. Provide extended warranties where specifically required in subsequent sections of Division 22.

### **PART 2 PRODUCTS**

#### **2.01 GENERAL**

- A. In addition to material and equipment specified, provide incidental materials to affect a complete installation. Such incidental materials include solders, tapes, caulking, mastics, gaskets and similar items.
- B. Materials and equipment shall be uniform throughout the installation. Equipment of the same type shall be of the same manufacturer. Materials and equipment shall be new.

**PART 3 EXECUTION****3.01 EXAMINATION OF SITE**

- A. Examine the site and become familiar with conditions that may affect the work covered by this division of the Specifications.
- B. Arrange to meet with the City of Portsmouth at the job site before the work is started and discuss with them the various phases of the work and the procedure and preparation for testing and adjusting the systems.
- C. The general arrangement and location of piping ductwork, apparatus, etc., is shown on the Drawings or herein specified. Minor changes may be necessary to accommodate other work, new or existing, that may conflict with this work. Install this work in harmony with these trades and fully coordinate work.
- D. Visit the site of the work, take measurements, examine areas where work is to be performed and get such other information necessary for proper execution of the work. Ascertain and check conditions with the Drawings and Specifications, other trades, existing conditions and by what means the work is to be performed. No allowance shall subsequently be made for extra expense due to failure or neglect to make such examination and correlation. Where revisions or changes in the existing work are required to permit the installation of new work, they shall be made at no additional cost to the City of Portsmouth. No allowance shall be subsequently made for error or omission.

**3.02 ACCURACY OF DATA**

- A. The Drawings indicate the general arrangement and location of piping, ducts, and equipment. Should it be necessary to deviate from arrangement or location indicated in order to meet architectural conditions or site conditions, or due to interference with other work, make such deviations as offsets, rises and drops in piping and ducts that may be necessary, whether shown or not, without extra expense to the City of Portsmouth. Extreme accuracy of the data given herein and on the Drawings is not guaranteed. The Drawings and Specifications are for the assistance and guidance of this Section and exact locations, distances, and elevations shall be governed by actual site conditions.

**3.03 COORDINATION ITEMS**

- A. Coordinate mechanical work with that of other trades in order to:
  - 1. Avoid interferences between general construction, mechanical, electrical, structural and other specialty trades.
  - 2. Maintain clearances and advise other trades of clearance requirements for operation, repair, removal and testing of mechanical equipment.
- B. Understanding of Work:
  - 1. Study, examine, and compare of the contract documents, including drawings and specifications. The Subcontractor shall have a full understanding of how the work in this part is scheduled, phased, and installed with work of other trades.
  - 2. Include in this installation piping, ductwork, devices, and equipment that are necessary for complete and operating systems as specified and as required.
  - 3. Connect piping and ductwork from fixtures, outlets, and devices full size to the nearest suitable main or riser.
  - 4. Certain installations may be presented as typical, and full details are not repeated for each case. Subcontractor shall provide complete installation as if full details apply to each and every case, and make adjustments to typical details to suit each specific installation as part of



- the basic work.
5. Installation of work presented on the diagrams are applicable to the plans, and work depicted on the plans are applicable to the diagrams.
  6. If there is a discrepancy in the drawings or specifications, the contractor shall figure the work based on the most stringent requirements to complete the installation and obtain clarification from the Architect before installation.
- C. Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
1. Coordinate mechanical systems, equipment, and materials installation with other building components.
  2. Verify dimensions by field measurements.
  3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
  4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
  5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
  6. Where mounting heights are not detailed or dimensioned, install systems, materials and equipment to provide the maximum headroom possible. Work shall be above ceilings or ceiling line.
  7. Coordinate installation and connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
  8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Coordinate with individual system requirements.
  9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
  10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as is practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
  11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
  12. Coordinate with the locations of electrical panels and avoid installing piping and ductwork over them. Electrical panels are purposely located and have priority for location. The contractor is responsible for required piping and ductwork offsets to insure that the panels are located as designed and for other conditions.
  13. Perform system modification recommended by Test and Balance Agency after recommendations are accepted by the City of Portsmouth.

### **3.04 WORKMANSHIP AND SUPERVISION**

- A. Comply with of the following:
- B. Measurements: Materials installed shall be to exact field measurements.
- C. The installation depicted on the Drawings is designed to fit tightly into work under other Sections or Divisions. It is the essence of this Contract that work be completely coordinated with other

Sections or Divisions, and that locations of pipes and ducts be exactly determined in the field and cleared with other Sections or Divisions before the installation of these items is begun. No extra compensation will be made for failure to observe this clause.

- D. Adequate clearance for access to operable devices and automatic devices and for access to lubrication points shall be maintained in portions of the work including ductwork and piping installed on the roof. Tripping hazards shall be avoided.
- E. Provide architectural access doors where shown and where required for access to equipment and operable devices.
- F. Gauges, thermometers, and other indicating devices shall be installed so that they can be easily read from the floor.

### **3.05 INSTALLATION**

- A. Manufacturer's Directions: Follow manufacturer's directions covering points not shown on the drawings or specified herein. Manufacturer's directions do not take precedence over drawings and Specifications. Where these are in conflict with the drawings and Specifications, notify the Project Manager for clarification before installing the work.
- B. Carpentry, Cutting, Patching, and Core Drilling:
  - 1. Provide carpentry, cutting, patching, and core drilling required for installation of material and equipment specified in this division.
  - 2. No penetrations shall be sleeved, cut, or core drilled through concrete construction without a submittal indicating exact locations and sizes and specific written approval from the City of Portsmouth or unless specifically shown on the Structural Drawings.
  - 3. It is the Subcontractor's responsibility to accurately size and locate openings through the structure. The dimensions shown on the Structural Drawings are for general information only. Provide specific sizes, dimensions, requirements, etc.
- C. Waterproof Construction:
  - 1. Maintain waterproof integrity of penetrations of materials intended to be waterproof. Provide flashings at exterior roof penetrations. Caulk penetrations of foundation walls and floors watertight. Provide membrane clamps at penetrations of waterproof membranes.
- D. Provide waterproof NEMA 3R enclosures for equipment or devices mounted outside or otherwise exposed to the weather.
- E. Sleeves, Stubs, and Slab Penetrations: Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment".
- F. Painting of Mechanical Equipment and Hardware:
  - 1. Comply with applicable Division 09 sections for paints and coatings.
  - 2. Provide moisture resistant paint for exterior painting.
  - 3. Colors shall be as shown on the drawings unless specified.
  - 4. Comply with individual Sections for other equipment to be painted.
  - 5. Repair damaged galvanizing, paint, or coatings. Use Z.R.C. (no known equal) cold galvanized compound for galvanized repairs.
- G. Concrete Equipment Bases:
  - 1. All equipment located on concrete floor inside the building or on grade outside the building, shall be mounted on a concrete base. The concrete base shall be four inches high and shall extend six inches beyond the edge of equipment base unless indicated otherwise on drawings.
  - 2. Coordinate concrete bases: Concrete bases indicated on Architectural or Structural drawings are specified in other Divisions. Concrete bases not on Architectural or Structural drawings are requirements of this Division.

**3.06 PIPING AND EQUIPMENT IDENTIFICATION**

- A. Comply with Division 22 Section "Identification for Plumbing Piping and Equipment."

**3.07 NOISE AND VIBRATION**

- A. The target room NC sound levels for the operating HVAC system is as follows, all units are dB(A):
1. Rooms with Fume Hoods 55 (not including fume hood components)
  2. Activity Rooms 36
  3. Office Spaces 36
  4. Storage Spaces 36
  5. Conference Rooms 36
  6. Corridors/Utility Areas 45
- B. If noise or vibration problems are a result of improper material or installation, or exceeds stated above, these conditions shall be corrected by the Subcontractor at no cost to the City of Portsmouth.

**3.08 PROTECTION OF EQUIPMENT**

- A. Care shall be exercised during construction to avoid damage or disfigurement. Equipment shall be protected from dust and moisture prior to and during construction. The Subcontractor is cautioned that concrete finishing, painting, etc. in electrical rooms shall not proceed if unprotected equipment is installed.
- B. Where required or directed, construct temporary protection for equipment and installations for protection from dust and debris caused by construction.
- C. All protection shall be substantially constructed with the use of clean canvas, heavy plastic, visqueen and plywood as required, and made tight and dust proof as directed.
- D. The Subcontractor shall repair by spray or brush painting, after properly preparing the surface, scratches or defects in the finish of the equipment. Only identical paint furnished by the equipment manufacturer shall be used for such purposes.
- E. Failure of the Subcontractor to protect the equipment as outlined herein shall be grounds for rejection of the equipment and its installation.

**3.09 LUBRICATION**

- A. All lubrication points shall be accessible. Where this is impossible, provision shall be made for lubrication at an accessible location. Where oil is used, an oil level indicator and capped, vented filling connection shall be provided and firmly mounted in an accessible space and shall be connected to the bearing with pipe(s) as required. Where grease is used for lubricant, the pipe shall have a suitable lubricating fitting installed at the accessible end. Equipment shall be thoroughly lubricated before operation and at time work is accepted.

**3.10 SEALANTS**

- A. Completely seal duct, pipe and conduit penetrations through rated and non-rated walls.

**3.11 TESTS**

- A. Upon completion of the mechanical construction work, perform tests and provide test reports as specified in this and other sections.
1. All tests shall be made in the presence of a representative of the Project Manager. The application or interruption of mechanical utilities shall be programmed and directed by the Project Manager.
  2. The Subcontractor shall submit to the Project Manager 3 copies of test results, certified in writing, witnessed, signed and dated, immediately upon completion of work. Unsatisfactory

condition revealed by these test results, or unsatisfactory methods of tests and/or testing apparatus and instruments, shall be corrected by the Subcontractor to the satisfaction of the Project Manager.

3. The Project Manager reserves the right to require that the Subcontractor perform and repeat tests that are deemed necessary to complete or check the tests or the certified records of the Subcontractor during the course of the work. Correct unsatisfactory portion of its work that is revealed by the tests or that may be due to progressive deterioration during this period, unless the item in question was a direct specification.

### **3.12 COMMISSIONING**

- A. Commissioning is included as a part of the total package of quality assurance and quality control for this project. Commissioning is to be integrated into the project as the process that oversees and verifies the functional performance of equipment, systems, and assemblies via observation and testing. Include coordination with and full participation in the commissioning process. Commissioning shall include but not be limited to field observations, factory and site tests, pre-start checks, start-up checks, functional test procedure review, functional testing, commissioning meetings, documentation, test interpretation, and deficiency correction. The details of these requirements are described in the above Sections and other referenced Sections and are hereby incorporated by reference into the work of this Division.

### **3.13 MAINTENANCE AND OPERATING INSTRUCTIONS AND TRAINING**

- A. At time of occupancy, arrange for manufacturer's representatives to instruct operating and maintenance personnel in the use of equipment requiring operating and maintenance. Arrange for personnel to be instructed at one time. Costs for this service shall be included in the Subcontract.
- B. Maintenance and operating instructions and training for City of Portsmouth-furnished equipment will be provided by the equipment vendor. The Subcontractor shall be responsible for other equipment.

**END OF SECTION**

**SECTION 22 05 23**  
**BALL VALVES FOR PLUMBING PIPING**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Brass ball valves.
  - 2. Bronze ball valves.

**1.02 DEFINITIONS**

- A. CWP: Cold working pressure.
- B. LF: Lead Free.
- C. MPTFE: Multi-Fill PTFE.
- D. MSS: Manufacturer's Standardization Society.
- E. NSF: National Sanitation Foundation.
- F. PTFE: Polytetrafluoroethylene.

**1.03 DELIVERY, STORAGE, AND HANDLING**

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, and soldered ends.
  - 3. Set ball valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

**PART 2 PRODUCTS**

**2.01 GENERAL REQUIREMENTS FOR VALVES**

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B1.20.1 for threads for threaded end valves.
  - 2. ASME B16.1 for flanges on iron valves.
  - 3. ASME B16.5 for flanges on steel valves.
  - 4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 5. ASME B16.18 for solder-joint connections.
  - 6. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 Annex G for valves in potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.

**2.02 BRASS BALL VALVES**

- A. Two-Piece, Brass Ball Valves with Full Port and Brass Trim:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Apollo, Conbraco Industries, Inc. 77FLF-100 Series (threaded connections) 77FLF-200 Series (solder connections) for potable-water applications; and Apollo, Conbraco Industries, Inc. for application other than potable water or where lead free certification is not required, or comparable product by one of the following:
    - a. Hammond Valve.
    - b. KITZ Corporation.
    - c. Red-White Valve Corporation.
    - d. Watts; a Watts Water Technologies company.
  - 2. Description:
    - a. Standard: MSS SP-110.
    - b. CWP Ratings for Threaded- and Soldered-End Valves NPS 1/4 to NPS 2(DN 8 to DN 50): 600 psig(4140 kPa).
    - c. CWP Ratings for Threaded- and Soldered-End Valves NPS 2-1/2 to NPS 4(DN 65 to DN 100): 400 psig (2760 kPa).
    - d. CWP Ratings for Valves with Press Connections: 250 psig(1723 kPa).
    - e. Body Design: Two piece.
    - f. Body Material: Forged brass for applications other than potable water; and LF forged brass for use in potable-water applications.
    - g. Ends: Threaded, soldered, press, and push as required by valve schedules below.
    - h. Seats: PTFE.
    - i. Stem: Brass for applications other than potable water; and LF Brass for use in potable-water applications.
    - j. Stem Packing: Adjustable.
    - k. Ball: Brass or chrome-plated brass for applications other than potable water; LF brass for use in potable-water applications.
    - l. Port: Full.

**PART 3 EXECUTION****3.01 EXAMINATION**

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

**3.02 VALVE INSTALLATION**

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

- E. Install valve tags, ensure durability and legibility.

**3.03 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE**

- A. Pipe 2" and Smaller:
  - 1. Brass Valves: May be provided with solder-joint ends instead of threaded ends.
  - 2. Two-piece, brass ball valves with full port.
  - 3. Two-piece, bronze ball valves with full port.

**END OF SECTION**

**SECTION 22 05 29**  
**HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Related Documents:
  - 1. Drawings and general provisions of the Subcontract apply to this Section.
  - 2. Review these documents for coordination with additional requirements and information that apply to work under this Section.
- B. Section Includes:
  - 1. Pipe, duct, and equipment hangers and supports.
  - 2. Anchors, equipment bases and supports.
  - 3. Sleeves and seals.
  - 4. Flashing, counter flashing and pipe stacks.
  - 5. Fire-stopping.

**1.02 REFERENCES**

- A. General:
  - 1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
  - 2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.
  - 3. Refer to Division 22 Section "Common Results for Plumbing" for codes and standards, and other general requirements.
- B. Code of Federal Regulations 29 CFR 1910.7:
  - 1. Definitions and Requirements for a Nationally Recognized Testing Laboratory (NRTL).
- C. National Fire Protection Association (NFPA)
  - 1. NFPA-13 Installation of Sprinkler Systems
  - 2. NFPA-14 Installation of Standpipe and Hose Systems
- D. Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA):
  - 1. Seismic Restraint Manual: Guidelines for Mechanical Systems - latest edition for the support of ductwork.
- E. UL Fire Resistance Directory, latest edition.

**1.03 SUBMITTALS**

- A. Submit under provisions of Division 22 Section "Common Results for Plumbing".
- B. Submit shop drawing of hanger and support spacing, framing and attachment methods.
- C. Submit fire-stopping systems for every application.

**1.04 QUALITY ASSURANCE**

- A. Comply with the following:
  - 1. Supports for Sprinkler Piping: NFPA 13.
  - 2. Supports for Standpipes: NFPA 14.
- B. Do not use black steel devices, components, fasteners, etc. within the Clean Room interstitial space or in related air flow path. Steel items shall be plated, galvanized, painted, or coated.

**PART 2 PRODUCTS**



**2.01 PIPE HANGERS AND SUPPORTS**

- A. Hangers for Pipe Sizes  $\frac{1}{2}$  (12.7 mm) to 1-1/2 Inch (38 mm): Carbon steel, adjustable swivel ring, UL listed, Grinnell Fig. 69 or equal. Use plastic coated hangers at all uninsulated copper piping.
- B. Hangers for Pipe Sizes 2 Inches (50.8 mm) and Cold Pipe Sizes 6 Inches (152.4 mm) and Over: Carbon steel, black or galvanized, adjustable, clevis, UL listed, Grinnell Fig. 260 or equal.
- C. Hangers for Hot Pipe Sizes 6 Inches (152.4 mm) and Over: Adjustable steel yoke, cast iron roll, double hanger.
- D. Trapeze Supports: 12 gauge channel complete with nuts, pipe clamps, pipe straps, and drive-in end caps. Furnish cushion strip on all uninsulated copper piping and; cast iron roll and stand for hot pipe sizes 6 inches and over.
- E. Pipe Supported Tight to Wall, Floor, or Ceiling: Superstrut A1200, Unistrut P1000, or equal, 12 gauge channel complete with pipe clamps, nuts, bolts, and end caps. Furnish cushion strip on all uninsulated copper piping. And adjustable steel yoke and cast iron roll for hot-pipe sizes 6 inches and over.
- F. Vertical Support: Steel riser clamp, UL listed, Grinnell Fig. 261, Superstrut C720, or equal.
- G. Floor Support for Pipe Sizes to 4 Inches (101.6 mm) and Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.
- H. Floor Support for Hot Pipe Sizes 6 Inches (152.4 mm) and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
- I. Shield for Insulated Piping 2 Inches and Smaller: 18-gauge (1.31 mm) galvanized steel shield over insulation in 180 degree segments, at least 12 inches (300 mm) long at pipe support.
- J. Pipe Shields: Pipe Shields Inc., FRI, or equal, pipe hanger shield with waterproofed calcium silicate insulation encased in a galvanized metal casing completely around the pipe. Provide insulation same thickness as pipe insulation. Furnish the following models:
  - 1. Chilled Water: A2000 with calcium silicate insulation extending 1 inch (25 mm) beyond the metal casing.
  - 2. All others: A1000.
- K. Concrete Anchors: In accordance with Division 03 Section "Concrete Accessories".

**2.02 DUCT SUPPORTS**

- A. See Division 23 Sections "Metal Ducts" and "Metal Ducts Fittings".

**2.03 HANGER RODS**

- A. Steel, threaded both ends, threaded one end, or continuously threaded.

**2.04 ATTACHMENTS TO STRUCTURE**

- A. Inserts for new formed concrete construction: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods. For Suspension from New Formed Concrete Structure: Grinnell Figure 282, Superstrut 452, or equal, UL listed for the rod sizes, Grinnell, Fig. 282, Superstrut 452, or equal.
- B. Connection to Existing Concrete Structure: Hilti Kwik-Bolt, Phillips or equal, wedge type expansion anchors. Powder-driven fasteners may be used only for flexible duct, metal duct up to 16 inches (400 mm) round (or rectangular equivalent), and for air inlet and outlet wire seismic braces, and only within the parameters of the fastener's ICBO report. Provide current ICBO report. Do not use powder-driven fasteners for pipes or conduits.
- C. For Suspension from New Formed Concrete Structure: B-Line B3014, Grinnell Figure 282, Superstrut 452, or equal, adjustable concrete insert.

- D. For Support on New Concrete: Galvanized steel headed bolts.
- E. Welded Connection to Steel Beams: B-Line B3083, Grinnell, Superstrut, or equal, steel welded beam attachment.
- F. Clamp Connection to Steel Beams: B-Line, Grinnell, Superstrut, or equal, beam clamp with retaining clip style as required by load.

## **2.05 SUPPORTS, BRACING, AND ACCESSORIES**

- A. Miscellaneous Steel: Angles, channels, brackets, rods, clamps, etc., of new materials conforming to ASTM A36. Hot-dip galvanize steel parts after fabrication where used outdoors or inside the penthouse.
- B. Fasteners: Bolts and nuts, except as otherwise specified, shall conform to ASTM Standard Specifications for Low Carbon Steel Externally and Internally Threaded Standard Fasteners, Designation A307. Bolts shall have heavy hexagon heads, and nuts shall be of the hexagon heavy series. Bolts, washers, nuts, anchor bolts, screws and other hardware used outdoors or inside the penthouse shall be galvanized, and galvanized nuts shall have a free running fit. Provide bolts of ample size and strength for the purpose intended. Ferrous metal components below grade shall be stainless steel.
- C. Sheet Metal Screws: Plated, size 10 minimum.
- D. Pre-engineered duct and pipe bracing systems may be Mason Industries Seismic Sway Brace System or equal.

## **2.06 COUNTER FLASHING**

- A. Metal Flashing: 26-gauge galvanized steel.
- B. Flexible Flashing: 47-mil thick sheet butyl; compatible with roofing.
- C. Caps: Steel, 16 gauge.

## **2.07 EQUIPMENT CURBS**

- A. See Architectural and Structural Drawings for the design detail of the equipment curb.

## **2.08 SLEEVES**

- A. Adjust-To-Crete, AMI Products, or equal, 24 gauge, electro-galvanized adjustable sleeve, up to 6" diameter. For 8 inches (200 mm) and larger, provide galvanized standard weight steel pipe sleeves
- B. Sleeves for Round Ductwork: Form with galvanized steel.
- C. Sleeves for Rectangular Ductwork: Form with galvanized steel or wood.
- D. Caulk: Acrylic sealant.

## **2.09 FABRICATION**

- A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- B. Design hangers for installation without disengagement of supported pipe.

## **2.10 FINISH**

- A. Prime-paint exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
  - 1. Steel in the Clean Room interstitial space is considered exposed.
- B. Hot-dip galvanized outdoors.
  - 1. Repair damage to galvanizing at welds, scratches, etc. using Z.R.C. (no known equal) cold galvanizing compound.

**PART 3 EXECUTION****3.01 ATTACHMENTS TO STRUCTURE**

- A. Concrete Structure: Locate anchors from Edge condition and at a spacing to obtain maximum working loads specified in the applicable ICC report.
  - 1. See structural drawings for additional restrictions for locating anchors.
- B. Steel Structure: Attach at beam axis. Avoid eccentric loads wherever possible.
- C. Rating: Ultimate strength at least five times the imposed load.
- D. Submit for structural review pipe hanger locations, point loads and structural attachment details for pipes 6" and larger.
- E. Coordinate installation so that attachments to structure are made prior to fireproofing. If attachments must be made after fireproofing, then thoroughly clean area of fire proofing before welded or bolted attachments are made and replace fireproofing as necessary. Fireproofing material shall match existing.
- F. Where point loads, imposed by work of Division 22, are greater than can safely be carried by the roof or deck, provide structural steel spreader beams tied to the building structure. Submit details of such spreader beams for approval.
- G. Inserts:
  - 1. Furnish inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
  - 2. Where concrete slabs form finished ceiling, furnish inserts to be flush with slab surface.
  - 3. Where inserts are omitted, submit an attachment plan to the Building Owner.

**3.02 SUPPORTS, BRACING, AND ACCESSORIES**

- A. Common support systems: This section is responsible for the provision, coordination, calculations, and seismic bracing of support systems common to Division 22 work. Individual section shall provide their own horizontal support struts.
- B. Set machines and devices dead level, except where pitch or slope is specified or shown. Securely fasten to the structure unless shown otherwise. Use dry pack cement grout to obtain complete contact between structure and equipment.
- C. This Section is responsible for the concrete work for the support of equipment provided by this Section. Coordinate locations with anchor bolts before concrete is placed.
- D. Pipe Hangers and Supports:

Pipe Size	Maximum Hanger Spacing	Hanger Diameter
1/2 to 1-1/4 inch (12.7 to 31.75 mm)	6 feet 6 inches (2 m)	3/8 inch (9.5 mm)
1-1/2 to 2 inch (38.1 to 50.8 mm)	10 feet (3 m)	3/8 inch (9.5 mm)
2-1/2 to 3 inch (63.5 to 76.2 mm)	10 feet (3 m)	1/2 inch (12.7 mm)
4 to 6 inch (101.6 to 152.4 mm)	10 feet (3 m)	5/8 inch (15.9 mm)
8 to 12 inch (203.2 to 304.8 mm)	14 feet (4.25 m)	7/8 inch (22.2 mm)
14 inch (355.6 mm) and over	20 feet (6 m)	1 inch (25 mm)

PVC (All sizes)	6 feet (1.8 m)	3/8 inch (9.5 mm)
C.I. Bell and Spigot (or No-Hub)	5 feet (1.5 m) at joints	3/8 inch (9.5 mm)
<ol style="list-style-type: none"> <li>1. Install hangers to provide at least 1/2 inch (13 mm) space between finished covering and adjacent work.</li> <li>2. Place a hanger within 12 inches (300 mm) of each horizontal elbow.</li> <li>3. Use hangers with at least 1-1/2 inch (38 mm) vertical adjustment.</li> <li>4. Support horizontal cast iron pipe adjacent to each hub, with 5 feet (1.5 m) maximum spacing between hangers.</li> <li>5. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.</li> <li>6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers. Use specified pipe shields (if applicable). Trapeze size, and support size and spacing shall be governed by the cumulative weight of the supported piping. Maximum trapeze deflection shall be 1/240th of the span on a maximum stress of 15,000 psi (103.5 MPa), whichever is more stringent.</li> <li>7. Support riser piping independently of connected horizontal piping.</li> <li>8. Brace piping longitudinally and transversely as specified and indicated on the drawings.</li> <li>9. Support pipe from the building structure so that there is no apparent deflection in pipe runs. Fit piping with steel sway braces and anchors to prevent vibration and/or horizontal displacement under load when required. Do not support from, or brace to, ducts, other pipes, conduit, or materials except building structure. Piping or equipment shall be immobile and shall not be supported or hung by wire, rope, plumber's tape, plastic ties, or blocking of any kind. Vertical piping running between floors shall be additionally supported at mid points in a rigid and immobile fashion. Exposed or concealed piping which can be physically moved, and which is not properly supported will not be accepted, and additional support or bracing will be required. Install seismic bracing as at locations as specified in the contract drawings.</li> <li>10. Install and secure equipment with anchors and braces to floors, structural members and walls with sufficient backing, to prevent vibration and/or horizontal displacement under load and seismic force as hereinbefore specified. Follow manufacturer's recommendations for the installation of vibration isolators where required for equipment requiring such.</li> </ol>		
E. Equipment Bases and Supports:		
<ol style="list-style-type: none"> <li>1. Comply with Division 03 Sections "Concrete" and "Concrete Forming" for concrete bases.</li> <li>2. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.</li> <li>3. Construct support of steel members. Brace and fasten with flanges bolted to structure. Level equipment installed on steel rails using shims to compensate for the deflection of the steel.</li> <li>4. Provide rigid anchors for pipes after vibration-isolation components are installed.</li> </ol>		
F. Counter Flashing:		
<ol style="list-style-type: none"> <li>1. See Architectural Drawings for flashings.</li> <li>2. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weatherproofed or waterproofed walls, floors, and roofs.</li> <li>3. Counterflash vent and soil pipes projecting at least 3 inches (75 mm) above finished roof surface with lead worked at least 1 inch (25 mm) into hub, at least 8 inches (200 mm) clear on sides using 24 inches (600 mm) by 24 inches (600 mm) sheets. For pipes through outside walls, turn flanges back into wall and caulk, metal counterflash, and seal.</li> <li>4. Counterflash floor drains in floors with topping over finished areas with lead, 10 inches (250 mm) clear on sides using at least 36 inches by (900 mm) 36 inches (900 mm) sheets. Fasten flashing to drain clamp device.</li> <li>5. Seal floor, shower, mop sink, and drains watertight to adjacent materials.</li> </ol>		

6. Provide acoustical-lead flashing around ducts and pipes penetrating equipment rooms, installed in accordance with manufacturer's instructions for sound control.
  7. Provide curbs for mechanical roof installations at least 14 inches (350 mm) high above roofing surface. Counterflash with flexible sheet and counterflash with sheet metal; seal watertight.
- G. Sleeves:
1. Set sleeves in position in formwork. Provide reinforcing around sleeves.
  2. Extend sleeves through floors 1 inch (25 mm) above finished floor level. Caulk sleeves full depth and provide floor plate.
  3. Where piping or ductwork penetrates floor, ceiling, or wall, close-off space between pipe or duct and adjacent work with fire-stopping insulation and caulk airtight. Provide close-fitting metal collar or escutcheon covers at both sides of penetration.
  4. Install chrome-plated steel escutcheons at finished surfaces.

**END OF SECTION**

**SECTION 22 11 00  
FACILITY WATER DISTRIBUTION**

**PART 1 GENERAL****1.01 RELATED DOCUMENTS**

- A. 01 91 01 or 01 91 02 – Commissioning Process
- B. 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment
- C. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

**1.02 REFERENCE STANDARDS**

- A. ANSI A21.4
- B. ANSI A21.11
- C. ANSI A21.51
- D. ANSI B16.3 Malleable Iron Threaded Fittings
- E. ANSI B16.4 Cast Iron Threaded Fittings
- F. ANSI B16.5 Pipe Flanges and Flanged Fittings
- G. ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
- H. ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
- I. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
- J. ASTM A105 Forgings, Carbon Steel, for Piping Components
- K. ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
- L. ASTM A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
- M. ASTM B32 Solder Metal
- N. ASTM B88 Seamless Copper Water Tube
- O. ASTM B280 Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
- P. ASTM B813 Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
- Q. ASTM D1785 Poly Vinyl Chloride (PVC) Plastic Pipe
- R. ASTM D2241 Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)
- S. ASTM D2464 Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
- T. ASTM D2466 Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
- U. ASTM D2513 Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
- V. ASTM D2564 Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
- W. ASTM D2657 Heat Fusion Joining of Polyolefin Pipe and Fittings
- X. ASTM D2774 Recommended Practice for Underground Installation of Thermoplastic Pressure Piping
- Y. ASTM D2855 Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings
- Z. ASTM D3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
- AA. ASTM D3222 Unmodified Poly Vinylidene Fluoride (PVDF) Molding Extrusion and Coating Materials
- BB. ASTM D4101 Propylene Plastic Injection and Extrusion Materials
- CC. ASTM F437 Threaded Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 80
- DD. ASTM F438 Socket Type Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 40
- EE. ASTM F441 Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe, Schedules 40 and 80

FF.	ASTM F493	Solvent Cements for Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe and Fittings
GG.	ASTM F656	Primers for Use in Solvent Cement Joints of Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
HH.	ASTM F876	Standard Specification for Crosslinked Polyethylene (PEX) Tubing
II.	ASTM F877	Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water
		1. Distribution Systems
JJ.	ASTM F1960	Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings
KK.	AWWA C904	Standard for Crosslinked Polyethylene (PEX) Pressure Pipe, 1/2-inch Through 3-inch, for
		1. Water Service
LL.	AWS A5.8	Brazing Filler Metal
MM.	AWWA C104	Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
NN.	AWWA C105	Polyethylene Encasement for Ductile Iron Piping for Water
OO.	AWWA C110	Ductile Iron and Gray Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids
PP.	AWWA C111	Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings
QQ.	AWWA C151	Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids
RR.	AWWA C153	Ductile Iron Compact Fittings, 3 In. Through 48 In., for Water and Other Liquids
SS.	AWWA C600	Installation of Ductile Iron Water Mains and Their Appurtenances
TT.	AWWA C651	Disinfecting Water Mains
UU.	AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution

### 1.03 SHOP DRAWINGS

- A. Schedule from the contractor indicating the ASTM, AWWA or CISPI specification number of the pipe being proposed along with its type and grade if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.
- B. Statement from manufacturer on his letterhead that pipe furnished meets the ASTM, AWWA or CISPI specification contained in this section.

### 1.04 QUALITY ASSURANCE

- A. Substitution of Materials: Refer to Section GC – General Conditions of the Contract, Equals and Substitutions.
- B. Order all copper, cast iron, steel, PVC and polyethylene pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.
- C. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the State.

### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.
- B. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so

they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

- C. Offsite storage agreements will not relieve the contractor from using proper storage techniques.
- D. Storage and protection methods must allow inspection to verify products.

#### **1.06 DESIGN CRITERIA**

- A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM, and AWWA specifications as listed in this specification.
- B. Construct all piping for the highest pressures and temperatures in the respective system.
- C. Non-metallic piping will be acceptable only for the services indicated. It will not be acceptable in ventilation plenum spaces, including plenum ceilings unless approved for this use.
- D. Where weld fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.
- E. Where ASTM A53 type F pipe is specified, grade A Type E or S, or grade B Type E or S may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.
- F. Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

#### **1.07 WELDER QUALIFICATIONS**

- A. Welding procedures, welders, and welding operators for all building service piping to be in accordance with certified welding procedures of the National Certified Pipe Welding Bureau and Section 927.5 of ASME B31.9 Building Services Piping or AWS 10.9 Qualification of Welding Procedures and Welders for Piping and Tubing. Before any metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section 927.6 of ASME B31.9 Building Services Piping.
  - a. Welder certifications are required to be renewed every three years. If qualification papers are needed on a project, verify that they are current.
- B. Before any polyethylene fusion welding is performed, Contractor to submit certification that the welders to be used on this project have successfully demonstrated proper welding procedures in accordance with the Code of Federal Regulations, Title 49, Part 192, Section 192.285.
- C. The Architect or Engineer reserves the right to test the work of any welder employed on the project, at the State's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project and all defective welds replaced.

### **PART 2 - PRODUCTS**

#### **2.01 DOMESTIC WATER**

- A. ABOVE GROUND:
  - 1. Type L copper water tube, H (drawn) temper, ASTM B88; wrought copper pressure fittings, ANSI B16.22; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP. Copper mechanical grooved fittings and couplings on roll grooved pipe may be used in lieu of soldered fittings. Mechanically formed brazed tee connections may be used in lieu of specified tee fittings for branch takeoffs up to one-half (1/2) the diameter of the main.
  - 2. Ductile iron pipe, thickness Class 53, AWWA C151/C115; with standard thickness cement mortar lining, AWWA C104; ductile iron mechanical grooved cement mortar lined fittings and



- couplings on cut grooved pipe, Class 350 12" and below, Class 250 above 12", AWWA C606; ductile iron or gray iron flanged cement mortar lined fittings, Class 250, AWWA C110; rubber gasket joints with non-toxic gasket lubricant, AWWA C111.
3. Stainless Steel pipe, all sizes: ASTM A312, Type 304, Schedule 10 or 40 pipe, dimensions conforming to
  4. ANSI/ASME B36.19M with threaded, welded or grooved joints. Systems used for potable water to include ANSI/NSF 61 lead free certification. Fittings: ASTM A276 and A312 outlets and austenitic stainless steel plain, threaded or grooved ends, Type 304 or 316. Grooved couplings may be standard painted ductile iron, with EPDM gaskets. 1 1/2" and larger: ASTM A312, Type 304/304L Schedule 10 stainless steel pipe, welded or roll grooved connections. Galvanic corrosion protection required when connecting to copper systems in accordance with manufacturer recommendation. Schedule 10 pipe threaded joints and cut grooved joints are not permitted. Schedule 5 pipe and mechanical press-fit joints are not permitted.
- B. Below ground 2-1/2" and smaller:
1. Type K copper water tube, O (annealed) temper, ASTM B88; with cast copper pressure fittings, ANSI B16.18; wrought copper pressure fittings, ANSI B16.22; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; or cast copper flared pressure fittings, ANSI B16.26.
- C. Below Ground 3" And Larger:
2. Ductile iron pipe, mechanical or push on joint, thickness Class 52, AWWA C151; with standard thickness cement mortar lining, AWWA C104; ductile iron or gray iron mechanical joint cement mortar lined fittings, Class 250, AWWA C110; ductile iron mechanical joint compact fittings, Class 350, AWWA C153; rubber gasket joints with non-toxic gasket lubricant, AWWA C111. Provide 8 mil tube or sheet polyethylene encasement of iron pipe and pipe fittings, AWWA C105.
- D. PVC pressure pipe, DR 18, Class 150, AWWA C900 and C905; with integral bell and elastomeric gaskets, ASTM D3139. Fittings and fitting polyethylene encasement to be same as noted above for ductile iron.
- a. Where corrosive soil conditions exist, PVC should be specified exclusively. These include highly alkaline soils, high salt (deicing) concentrations, cinder fills, waste dumps, peat bogs and swamps.
  - b. Do not specify PVC where ground is suspected of contamination by petroleum products or organic solvents.
- E. Underground To Interior Building Entrance Piping 3" And Larger:
1. Ductile iron as specified above with factory threaded and machined flanges.
- F. Thrust Restraints For Underground Piping:
1. Asphaltic or epoxy coated ductile iron follower gland mechanical joint restraint with gripping wedge restraints and torque limiting twist-off nuts around the pipe circumference, low alloy steel T-bolts and UL listing or Factory Mutual approval. For PVC pipe joint bells, use epoxy or primer coated ductile iron bell and serrated ring restraints or gripping wedge restraints and torque limiting twist-off nuts around the pipe circumference with low alloy steel tie bolts. Restraint to have minimum pressure rating and safety factor equal to or greater than pressure rating and safety factor of pipe and be designed specifically for the pipe material it's applied on.

## **2.02 DIELECTRIC UNIONS AND FLANGES**

- A. Watts Regulator Company, Lochinvar, Wilkins or EPCO Sales, Inc., dielectric unions 2" and smaller; dielectric flanges 2" and larger; with iron female pipe thread to copper solder joint or brass female pipe thread end connections, non-asbestos gaskets, having a pressure rating of not less than 175 psig at 180 degrees.

**2.03 UNIONS AND FLANGES**

- A. Unions, flanges and gasket materials to have a pressure rating of not less than 150 psig at 180 degrees. Gasket material for flanges and flanged fittings shall be teflon type. Treated paper gaskets are not acceptable.
- B. 2" And Smaller Steel:
  - 1. ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use galvanized malleable iron on galvanized steel piping. Use stainless steel unions for stainless steel piping.
- A. 2" And Smaller Copper:
  - 2. ANSI B16.18 cast bronze union coupling or ANSI B15.24 Class 150 cast bronze flanges.
- B. 2-1/2" And Larger Steel:
  - 1. ASTM A181 or A105, threaded only on galvanized steel. Use raised face flanges ANSI B16.5 for mating with other raised face flanges or equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face teflon gaskets for mating with other flat face flanges on equipment. Gaskets shall be teflon type.
- A. 2-1/2" And Larger Copper:
  - 1. ANSI B15.24 Class 150 cast bronze flanges with full face teflon gaskets.

**2.04 MECHANICAL GROOVED PIPE CONNECTIONS**

- B. Mechanical grooved pipe couplings and fittings, ASTM F1476, as manufactured by Victaulic, Gruitlok or Grinnell may be used with cut groove galvanized steel pipe, cut groove ductile iron pipe or roll groove copper pipe where noted. Mechanical grooved components and assemblies to be rated for minimum 250 psi working pressure.
- C. All mechanical grooved pipe material including gaskets, couplings, fittings and flange adapters to be from the same manufacturer.
- D. Couplings to be malleable iron, ASTM A47, or ductile iron ASTM A536 with painted finish. Reducing couplings are not acceptable.
- E. Fittings used on galvanized steel pipe to be malleable iron, ASTM A47, or ductile iron A536, with galvanized finish, ASTM A153. Fittings used on ductile iron pipe to be cement mortar lined ductile iron with coal tar coating, ASTM A536; conforming to requirements of AWWA C110/C153 and AWWA C606. Fittings used on copper pipe to be copper.
- F. Gaskets to be EPDM, ASTM D2000. Gaskets for hot water systems and dry pipe systems to be flush seal design. Heat treated carbon steel oval neck track bolts and nuts, ASTM A183, with zinc electroplated finish ASTM B633.
- G. Flange adapters to be ductile iron, ASTM A536; except at lug type butterfly valves where standard threaded flanges shall be used.
  - 1. Standard flanges are necessary so that the butterfly valve can be properly bolted to the flange and retain its place in the pipe when piping on one side is removed.
- H. Credit for the inherent flexibility of mechanical grooved pipe connections when used for expansion joints or flexible connectors may be allowed upon specific application by the Contractor. Three flexible couplings at first three connection points both upstream and downstream of pumps may be used in lieu of flexible connectors. Request for expansion joints shall be made in writing and shall include service, location, line size, proposed application and supporting calculations for the intended service.

**PART 3 EXECUTION****3.01 GENERAL**

- A. Install pipe and fittings in accordance with reference standards, manufacturers recommendations

and recognized industry practices.

### **3.02 PREPARATION**

- A. Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

### **3.03 ERECTION**

- A. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.
- B. Where copper, steel, or plastic piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.
- C. Install underground warning tape 6"-12" below finished grade above all exterior below ground piping. Where existing underground warning tape is encountered, repair and replace.
- D. Maintain piping in clean condition internally during construction.
- E. Provide clearance for installation of insulation, access to valves and piping specialties.
- F. Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.
- G. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment
  - 1. This requirement is based on NFPA 70, 384-4 and 450-47.
- H. PEXa pipe joint connections shall be installed per manufacturer's recommendations. Use manufacturer recommended cold-expansion tool for ASTM F 1960 connections.
- I. Do not expose PEXa piping to direct sunlight. Provide cover to portions of piping exposed to direct sunlight.
- J. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

### **3.04 COPPER PIPE JOINTS**

- A. Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

### **3.05 THREADED PIPE JOINTS**

- A. Use a thread lubricant or teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

### **3.06 SOLVENT WELDED PIPE JOINTS**

- A. Install in accordance with ASTM D2855 "Making Solvent Cemented Joints With PVC Pipe and Fittings". Saw cut piping square and smooth. Tube cutters may be used if they are fitted with

wheels designed for use with PVC/CPVC pipe that do not leave a raised bead on pipe exterior. Support and restrain pipe during cutting to prevent nicks and scratches. Bevel ends 10-15 degrees and deburr interior. Remove dust, drips, moisture, grease and other superfluous materials from pipe interior and exterior. Check dry fit of pipe and fittings. Reject materials which are out of round or do not fit within close tolerance. Use heavy body solvent cement for large diameter fittings.

- B. Maintain pipe, fittings, primer and cement between 40 and 100 degrees during application and curing. Apply primer and solvent using separate daubers (3" and smaller piping only) or clean natural bristle brushes about 1/2 the size of the pipe diameter. Apply primer to the fitting socket and pipe surface with a scrubbing motion. Check for penetration and reapply as needed to dissolve surface to a depth of 4-5 thousandths. Apply solvent cement to the fitting socket and pipe in an amount greater than needed to fill any gap. While both surfaces are wet, insert pipe into socket fitting with a quarter turn to the bottom of the socket. Solvent cement application and insertion must be completed in less than 1 minute. Minimum of 2 installers is required on piping 4" and larger. Hold joint for 30 seconds or until set. Reference manufacturers recommendations for initial set time before handling and for full curing time before pressure testing. Cold weather solvent/cement may be utilized only under unusual circumstances and when specifically approved by the DPW Project Representative.

### **3.07 MECHANICAL HUBLESS PIPE CONNECTIONS**

- A. Place the gasket on the end of one pipe or fitting and the clamp assembly on the end of the other pipe or fitting. Firmly seat the pipe or fitting ends against the integrally molded shoulder inside the neoprene gasket. Slide the clamp assembly into position over the gasket. Tighten fasteners to manufacturers recommended torque.

### **3.08 MECHANICAL JOINT PIPE CONNECTIONS**

- A. Comply with AWWA C600/C605 installation requirements. Clean pipe end and socket. Clean and lubricate pipe end, socket and gasket with soapy water or gasket lubricant. Place gland and gasket, properly oriented, on pipe end. Insert pipe end fully into socket and press gasket evenly into recess keeping joint straight. Press gland evenly against gasket, insert bolts and hand tighten nuts. Make joint deflection prior to tightening bolts. Evenly tighten bolts in sequence to recommended torque.

### **3.09 PUSH-ON GASKETED PIPE CONNECTIONS**

- A. Clean pipe end, bell, gasket seat and gasket of dirt or debris. Coat end of pipe and gasket with gasket lubricant. Insure pipe is supported off the ground so lubricant does not pick up dirt. Push spigot end into gasket bell with levered pipe joining tool recommended by pipe manufacturer. Large diameter exterior mains may be joined by pushing end of pipe section with backhoe against wood blocking over pipe end. Insert to fully seated position or to reference mark on pipe.

### **3.10 MECHANICAL GROOVED PIPE CONNECTIONS**

- A. Use pipe factory grooved in accordance with the coupling manufacturer's specifications or field grooved pipe in accordance with the same specifications using specially designed tools specially designed for the application. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance with the coupling manufacturer's specifications.

### **3.11 MECHANICALLY FORMED TEE FITTINGS**

- A. Form mechanically extracted collars in a continuous operation, consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the

thickness of the tube wall. Use an adjustable collaring device. Notch and dimple the branch tube. Braze the joint with neutral flame oxy-acetylene torch, applying heat properly so that pipe and tee do not distort; remove distorted connections.

### **3.12 DOMESTIC WATER**

- A. Maintain piping system in clean condition during installation. Remove dirt and debris from assembly of piping as work progresses. Cap open pipe ends where left unattended or subject to contamination.
- B. Install exterior water piping below predicted frost level in accordance with COMM Table 82.30-6, but in no case less than 6' bury depth to top of pipe. Maintain minimum of 8' horizontal distance between 2-1/2" and larger water piping and sanitary sewer piping. Maintain minimum of 30" horizontal and 12" vertical distance, water on top, between 2" and smaller water piping and sanitary sewer piping. Where water piping crosses a sanitary sewer, provide minimum 18" vertical clearance and waterproof PVC water pipe sleeve (reference sanitary sewer materials) sealed at both ends for distance of 10' from sewer in both directions.
- C. Provide thrust restraints for 3" and larger exterior water piping joints, hydrants, caps, plugs, fittings and bends of 22-1/2 degrees or more. Field apply continuous anti-corrosion coating to rodded restraint components. Protect mechanical joints, nuts and bolts from concrete cover. Cover with 8 mil sheet or tube polyethylene material sleeve.
- D. Install interior water piping with drain valves where indicated and at low points of system to allow complete drainage. Install shutoff valves where indicated and at the base of risers to allow isolation of portions of system for repair. Do not install water piping within exterior walls.

### **3.13 FLUSHING AND DISINFECTION OF POTABLE WATER SYSTEMS**

- A. Prior to use, isolate and fill system with potable water. Allow to stand 24 hours. Flush each outlet proceeding from the service entrance to the furthest outlet for minimum of 1 minute and until water appears clear. Fill system with a solution of water and chlorine containing at least 10 parts per million of chlorine and allow to stand for 24 hours. Flush system with potable water until chlorine concentration is no higher than source water level.
- B. Wait 24 hours after final flushing. Take samples of water for lab testing. The number and location of samples shall be representative of the system size and configuration and are subject to approval by Engineer. Test shall show the absence of coliform bacteria. If test fails, repeat disinfection and testing procedures until no coliform bacteria are detected. Submit test report indicating date and time of test along with test results.
- C. Piping that is pressure tested shall be drained completely dry. The piping system is not to be left full of
- D. stagnant water. The piping system, water heaters and water softeners shall not be filled until within 10 days of occupancy to guard against microbial growth.

### **3.14 UNDERGROUND PIPE WRAP**

- A. Use for steel piping encased in concrete or underground which is not in a conduit. Remove all dirt and other foreign material from exterior of pipe. Apply primer as recommended by the manufacturer. Use a spiral wrap process for applying tape to the pipe. Repair any breaks in the tape coating caused by the installation process.

### **3.15 DIELECTRIC UNIONS AND FLANGES**

- B. Install dielectric unions or flanges at each point where a copper-to-steel pipe connection is required in domestic water systems.

**3.16 UNIONS AND FLANGES**

- A. Install a union or flange at each connection to each piece of equipment and at other items which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union connection on the equipment side of the valve. Concealed unions or flanges are not acceptable.

**3.17 PIPING SYSTEM LEAK TESTS**

- A. Isolate or remove components from system which are not rated for test pressure. Test piping in sections or entire system as required by sequence of construction. Do not insulate or conceal pipe until it has been successfully tested.
- B. If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Backfill underground water mains prior to testing with the exception of thrust restrained valves which may be exposed to isolate potential leaks.
- C. For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.
- D. Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking will not be acceptable.
- E. Entire test must be witnessed by the Division's representative. All pressure tests are to be documented on Department of Public Works forms to be provided to the contractor.

		Test	Initial Test _____	Final Test _____		
<b>Section 1.01</b>	<b>SystemMedium</b>	<b>Pressure</b>	<b>Duration</b>	<b>Pressure</b>	<b>Duration</b>	
*Below Ground Domestic Water	Water	N/A		200 psig	2 hr	
Above Ground Domestic Water	Water	N/A		100 psig	8 hr	
Above Ground Non-potable Water	Water	N/A		100 psig	8 hr	
Below Ground Non-potable Water	Water	N/A		100 psig	8 hr	

\* Leakage on exterior mains 3" and larger may not exceed leakage calculated as follows:

$$\text{GPH Allowable Leakage} = \frac{(\text{Feet of Pipe}) (\text{Inches Dia. of Pipe}) (\text{Test Pressure})^5}{133,200}$$

Below Ground Domestic Water test pressure of 200 psig is required by NFPA 24 for private fire service mains. Small diameter piping not serving hydrants or buildings with fire protection systems may be tested at 150 psig.

**END OF SECTION**

**SECTION 22 11 16  
DOMESTIC WATER PIPING**

**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. Copper tube and fittings.
- B. Related Requirements:
  - 1. Section 02 66 00 "Water Supply" for water-service piping outside the building from source to the point where water-service piping enters the building.

**1.03 FIELD CONDITIONS**

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
  - 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of water service.
  - 2. Do not interrupt water service without Construction Manager's written permission.

**PART 2 PRODUCTS**

**2.01 PIPING MATERIALS**

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."
- C. Comply with NSF Standard 372 for low lead.

**2.02 COPPER TUBE AND FITTINGS**

- A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) and water tube, drawn temper.
- B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

**PART 3 EXECUTION**

**3.01 EARTHWORK**

- A. Comply with requirements in Section 31 00 00 "Site Clearing" for excavating, trenching, and backfilling.

**3.02 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance
- D. Install water-pressure-reducing valves downstream from shutoff valves.
- E. Install domestic water piping level without pitch and plumb.
- F. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- J. Install piping to permit valve servicing.
- K. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- L. Install piping free of sags and bends.
- M. Install fittings for changes in direction and branch connections.
- N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- O. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump.
- P. Install thermostats in hot-water circulation piping.
- Q. Install thermometers on outlet piping from each water heater.
- R. Install sleeves for piping penetrations of walls, ceilings, and floors.
- S. Install sleeve seals for piping penetrations of concrete walls and slabs.
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors.

### **3.03 JOINT CONSTRUCTION**

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- E. Push-on Joints for Copper Tubing: Clean end of tube. Measure and mark insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
- F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:



1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
- H. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

### **3.04 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
  1. Vertical Piping: MSS Type 8 or 42, clamps.
  2. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet(30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet(30 m): MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet(30 m) if Indicated: MSS Type 49, spring cushion rolls.
  3. Multiple, Straight, Horizontal Piping Runs 100 Feet(30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch(10 mm).
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  1. NPS 3/4(DN 20) and Smaller: 60 inches(1500 mm) with 3/8-inch(10-mm) rod.
  2. NPS 1 and NPS 1-1/4(DN 25 and DN 32): 72 inches(1800 mm) with 3/8-inch(10-mm) rod.
  3. NPS 1-1/2 and NPS 2(DN 40 and DN 50): 96 inches(2400 mm) with 3/8-inch(10-mm) rod.
  4. NPS 2-1/2(DN 65): 108 inches(2700 mm) with 1/2-inch(13-mm) rod.
  5. NPS 3 to NPS 5(DN 80 to DN 125): 10 feet(3 m) with 1/2-inch(13-mm) rod.
  6. NPS 6(DN 150): 10 feet(3 m) with 5/8-inch(16-mm) rod.
  7. NPS 8(DN 200): 10 feet(3 m) with 3/4-inch(19-mm) rod.
- E. Install supports for vertical copper tubing every 10 feet(3 m).
- F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
  1. NPS 1-1/4(DN 32) and Smaller: 84 inches(2100 mm) with 3/8-inch(10-mm) rod.
  2. NPS 1-1/2(DN 40): 108 inches(2700 mm) with 3/8-inch(10-mm) rod.
  3. NPS 2(DN 50): 10 feet(3 m) with 3/8-inch(10-mm) rod.
  4. NPS 2-1/2(DN 65): 11 feet(3.4 m) with 1/2-inch(13-mm) rod.
  5. NPS 3 and NPS 3-1/2(DN 80 and DN 90): 12 feet(3.7 m) with 1/2-inch(13-mm) rod.
  6. NPS 4 and NPS 5(DN 100 and DN 125): 12 feet(3.7 m) with 5/8-inch(16-mm) rod.
  7. NPS 6(DN 150): 12 feet(3.7 m) with 3/4-inch(19-mm) rod.
  8. NPS 8 to NPS 12(DN 200 to DN 300): 12 feet(3.7 m) with 7/8-inch(22-mm) rod.
- G. Install supports for vertical steel piping every 15 feet(4.5 m).
- H. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

### **3.05 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
  - 1. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.

### **3.06 IDENTIFICATION**

- A. Identify system components.
- B. Label pressure piping with system operating pressure.

### **3.07 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Piping Inspections:
    - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
    - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
      - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
    - c. Re-inspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for re-inspection.
    - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
  - 2. Piping Tests:
    - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
    - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
    - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
    - d. Cap and subject piping to static water pressure of 50 psig(345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
    - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
    - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### **3.08 ADJUSTING**

- A. Perform the following adjustments before operation:
  - 1. Close drain valves, hydrants, and hose bibbs.
  - 2. Open shutoff valves to fully open position.
  - 3. Open throttling valves to proper setting.

4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
  - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
  - b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

### **3.09 CLEANING**

- A. Clean and disinfect potable domestic water piping as follows:
  1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate system according to either of the following:
      - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm(50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm(200 mg/L) of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - d. Repeat procedures if biological examination shows contamination.
    - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Clean non-potable domestic water piping as follows:
  1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### **3.10 PIPING SCHEDULE**

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water piping, 2-1/2", shall be the following:
  1. Hard copper tube, ASTM B 88, Type L(ASTM B 88M, Type B); with brazed cast- or wrought-copper joints.

- E. Aboveground domestic water piping, NPS 2"(DN 50) and smaller, shall be the following:
  - 1. Hard copper tube, ASTM B 88, Type L(ASTM B 88M, Type B) ; cast- or wrought-copper, solder-joint fittings; and joints.

### **3.11 VALVE SCHEDULE**

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Use ball or gate valves for piping NPS 2(DN 50) and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2(DN 65) and larger.
  - 2. Throttling Duty: Use ball or globe valves for piping NPS 2(DN 50) and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2(DN 65) and larger.
  - 3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
  - 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
- C. Iron grooved-end valves may be used with grooved-end piping.

**END OF SECTION**

**SECTION 23 05 00  
COMMON WORK RESULTS FOR HVAC**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Related Documents:
  - 1. Drawings and general provisions of the Subcontract apply to this Section.
  - 1. Review these documents for coordination with additional requirements and information that apply to work under this Section.
- B. Section Includes:
  - 2. Furnish services, skilled and common labor, and apparatus and materials required for the complete installation as shown and within the intent of the drawings and/or these Specifications.
- C. Requirements of this section apply to Division 23 Sections.

**1.02 REFERENCES**

- A. General:
  - 1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
  - 2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.

**1.03 DESCRIPTION**

- A. These Division 23 specifications define the statutory, administrative, procedural, and technical requirements of the mechanical and controls modifications, replacements, and/or upgrades products and services to be provided on this Subcontract.
- B. Provide HVAC work as indicated on the Drawings and specified in Division 23 including:
  - 1. Prepare coordination drawings, shop drawings, submittals, as-built drawings, and operating and maintenance instructions.
  - 2. Determine items and quantities required.
  - 3. Provide complete, continuous, operational, and functioning systems.
  - 4. Fully coordinate with work of other Sections, including field verification of elevations, dimensions, clearance, and access.
  - 5. Repair of all damage done to premises as a result of this installation and removal of debris left by those engaged in this installation.
  - 6. Rigging, hoisting, transportation, and associated work necessary for placement of equipment in the final location shown.
  - 7. Disassembly and re-assembly of equipment furnished under this Section, should this be required in order to move equipment into final location shown on the Drawings.
  - 8. Labor, materials, tools, appliances and equipment that are required to furnish and install the complete installation for this section of the work including that which is reasonably inferred.
  - 9. Cooperation with other crafts in putting the installation in place at a time when space required is accessible.
  - 10. Temporary scaffolding necessary for performance of the work in this Division.
  - 11. Cutting and core drilling required for work of Division 23, including locating of rebar or coordination of locating rebar with the General Contractor.
  - 12. Pipe sleeves for all holes in walls, floors, and ceilings, and cutting of floor slabs and slabs on

- grade.
13. Waterproofing where necessary for installation under this Division.
  14. Cooperation with and assistance to the Facilities Monitoring and Control System Contractor as required to provide a complete and functional HVAC system.
  15. Counterflashing of roof penetrations for work of Division 23.
  16. Sizes and locations for installation of any curbs and pads for work of Division 23.
  17. Temporary and permanent stands and supports for equipment requiring them including vibration isolation.
  18. Temporary protection of existing installation.
  19. Stenciling and equipment identification.
  20. Firestopping of penetrations of ducts, piping, and conduits through walls, floors, and ceiling assemblies.
  21. Temporary utilities as required to install work on Division 23 including lighting, water, gas, electricity, etc.
  22. Fees, permits, inspections, taxes, and approach from agencies that have jurisdiction over installation of Division 23.
  23. Air and water balancing.
  24. Participation in and coordination with the Commissioning process.
  25. Warranty.

#### **1.04 QUALITY ASSURANCE**

- A. Product Data: Submit manufacturer's technical product specification sheets for each system component and device to be provided that includes data needed to prove compliance with this specification. Clearly indicate the exact model of each component to be provided.
- B. Shop Drawings: The Subcontractor shall submit for approval shop drawings as required by other sections of these specifications.
  1. Shop drawings shall be drawn to a scale of 1/4 inch = 1 foot (1:25) or larger, and shall include complete dimensions, locations, elevations, and clearances for HVAC, piping, ductwork, equipment, and valve numbers.
    - a. Prepare in AutoCAD 2010 format or as otherwise directed.
    - b. Identify equipment using designations shown on the Contract Documents or as directed by the Owner. Do not proceed with identifications without approval from the Owner.
  2. All shop drawings shall clearly call out in bold letters and cloud symbols deviations from the specifications and contract documents, no matter how minor.
- C. Coordination Drawings:
  1. Obtain drawings from the structural, electrical, sprinkler, plumbing, sheet metal, concrete, steel, and dry wall trades.
  2. Hold regular coordination sessions with trades until coordination issues are resolved.
  3. Prepare separate composite coordination drawings to a scale of 1/4 inch = 1 foot (1:25) or larger, showing work of Divisions to demonstrate coordination, clearance, access, etc. between ductwork, equipment, temperature controls, cable trays, conduits, light fixtures, piping, plumbing, structural elements, architectural elements, etc. These drawings are to be the basis for the detailed shop drawings and need not be submitted, but are to be available for review upon request.
    - a. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
    - b. Each trade is to adjust their shop drawings based on the outcome of coordination sessions.
  4. Indicate locations where space is limited for installation and access and where sequencing

- and coordination of installations are of importance to the efficient flow of the Work.
5. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
  6. Indicate the proposed locations, of piping, ductwork, equipment, and materials. Include the following:
    - a. Clearances for installing and maintaining insulation.
    - b. Clearances for servicing and maintaining equipment, including specific ceiling tile or ceiling access panel access and space for equipment disassembly required for periodic maintenance.
    - c. Equipment connections and support details.
    - d. Fire-rated wall and floor penetrations.
    - e. Sizes and location of required concrete pads and bases.
    - f. Valve stem movement with valve stem located horizontally.
    - g. Sizes and locations of new and existing equipment support curbs on roof.
    - h. Sizes and locations of new openings, either sleeved, cut, or core-drilled, in new concrete construction unless specifically shown on the Structural Drawings.
  7. Maintain one complete set of composite coordination drawings at the job site. Periodically update drawings based on actual field conditions.
  8. Submit final coordination drawings as part of record document requirements.
- D. Operations and Maintenance Data: Submit manufacturer's operation and maintenance (O&M) manuals and equipment data sheets.
1. The O&M manual shall identify the specific equipment installed with model number and manufacturer serial number and equipment data sheet.
  2. The completed data sheet shall be submitted at the same time as the O&M manual. The equipment data sheet template provided in Paragraph 3.19, Equipment Data Sheet, of this Section shall be used.
  3. A list of spare parts that the manufacturer recommends the Owner purchase shall be included with the O&M manuals.
- E. Lateral Force Anchorage: Submit lateral force anchorage calculations and details of anchorage of components to building including backing design.
- F. Record Documents: Upon completion of the work covered by this Contract, as directed, furnish the Owner with as-built drawings. Include changes installed under this Contract which are not in accordance with the Contract Drawings. Note that these as-built drawings are to be based on the Contract Drawings. In addition, submit final copies of the Shop Drawings and Coordination Drawings.

#### **1.05 QUALITY ASSURANCE**

- A. Materials and Equipment: Materials and equipment shall be new. Materials and equipment for which tests have been established by Underwriter's Laboratories, Inc. shall be approved by that body and shall bear its label of approval.
1. The first names manufacturer and product is the basis of design. Other manufacturers and products are considered as substitutions.
- B. In lieu of listing by an approved testing laboratory, consideration will be given to certified test reports of an adequately equipped, recognized independent test laboratory competent to perform such testing indicating conformance to requirements of the applicable Underwriter's Laboratories, Inc. standards.
- C. Unless otherwise approved by the Project Manager, the materials to be furnished under this specification shall be the standard products of manufacturers regularly engaged in the production of such equipment equal to or superior to the material specified, and shall be the manufacturer's

latest standard design that complies with the specification requirements.

**D. Approval of Materials:**

1. A complete list of materials and equipment proposed shall be submitted to the Project Manager for approval. The list shall include for each item: the manufacturer, the manufacturer's catalog number, type or class, the rating, capacity, size, etc.
2. Before installation of the equipment, the Subcontractor shall submit for approval detailed construction drawings for each item of fabricated equipment required for installation. Drawings shall be to scale and fully dimensioned and shall provide sufficient detail to clearly indicate the arrangement of equipment and its components.
3. Installation of approved substituted equipment is the Subcontractor's responsibility, and changes required to work included under other divisions for installations of approved substituted equipment must be made to the satisfaction of the Owner and without change in contract price. Approval by the Owner of substituted equipment and/or dimension drawings does not waive these requirements.

**1.06 START-UP TRAINING**

- A. Assist in preparing a formal training program for operating staff prior to the scheduled start-up date. The program will consist of the design, start-up, and operation of the mechanical, plumbing, fire protection, and building automation systems. Coordinate the training program with the production of the operation and maintenance manuals. Provide indexed binder and training materials to each participant.
- B. Provide 16 hours (unless specified otherwise) of on-site training in the operation and maintenance for installed system and major piece of equipment. Systems include boilers and heating hot water system, chillers and chilled water system, plumbing, fire protection, air supply and exhaust systems, air conditioning units, balancing, and Facilities Monitoring and Control System. Trainers shall be experienced, manufacturer-approved personnel. Local manufacturer's sale representative is not acceptable.
  1. Schedule training for each system in advance with the Building Owner.
  2. Include travel, per diem and incidental costs for personnel under contract to the Subcontractor.
  3. Operations and Maintenance data to be available for training sessions.

**1.07 RULES AND REGULATIONS**

- A. Provide work and materials in full accordance with the latest rules of the organizations listed in Division 23, and with prevailing rules and regulations pertaining to adequate protection and/or guarding of moving parts, or otherwise hazardous locations.
- B. Whenever the Drawings and Specifications require something which will violate the regulations, the regulations shall govern. Review the Drawings and Specifications, and request from the Owner clarification or revision of portion of the work in violation of the rules or regulations prior to installing the work. Necessary installation alteration required for compliance shall be made at no additional cost to the Owner.
- C. Whenever the Drawings and Specifications require larger sizes, or higher standards than are required by the regulations, the Drawings and Specifications shall govern.
- D. Strictly conform to the requirements of the National Fire Protection Association, National Electrical Code, OSHA, Fire Marshal, and insurance underwriters' requirements. Expenses required shall be borne under this Contract.

**1.08 PROTECTION OF EQUIPMENT**

- A. Assume responsibility for damage to of the work or premises before substantial completion.



Should new or existing equipment become damaged, restore it to its original condition and finish before final acceptance. Damage incurred to the Owner property or to the work of other Divisions, caused by this Division, shall be replaced or repaired by, and at the expense of, the Subcontractor to the satisfaction of the Owner. Exposed materials shall be clean at the time of acceptance of the project.

#### **1.09 SCHEDULING AND SEQUENCING**

- A. Cooperate with other trades in putting this installation in place at a time when space required is accessible, and in such a manner that other work in this space may be installed as shown on the Drawings. Schedule work and cooperate with the others to avoid delays, interferences, and unnecessary work, conforming to the construction schedule, making the installation when and where directed.
  - 1. Include labor and materials to install certain items furnished under this contract when required by the schedule. These items are part of this contract but may need to be installed only after completion of work under another contract which this contractor may or may not be participating in. It is the responsibility of this contract to coordinate with others to insure that preparations are made and ready to accept the installation of these items. These items include, but are not limited to:
    - a. Air inlets and outlet
    - b. Temperature sensors.
    - c. Monitoring and control panels.
    - d. Sprinkler heads.
- B. If a discrepancy is discovered between engineering and architectural Drawings, whether with respect to a significant variance between location, variation in quantity, or violation of code requirements, notify Architect for clarification and do not proceed with the work affected until clarification has been made.
- C. Schedule work in advance with the Building Owner. No system shall be shutdown unless approved in writing.

#### **1.10 TEMPORARY USE**

- A. Should it become necessary to use the new portion of the system and the new equipment to warm or air condition part of the building before the completion of this work, the Owner reserves the right to make use of same at its own risk and expense, but the temporary use of the equipment shall not constitute an acceptance of the plant or part thereof in way. The Owner will bear the cost of fuel and electrical current for such temporary use of the equipment. If temporary use of new systems or equipment is solely for the benefit of the contractor, contractor shall bear the cost of fuel and electrical current for such temporary use.

#### **1.11 WARRANTY**

- A. Provide extended warranties where specifically required in subsequent sections of Division 23.

### **PART 2 PRODUCTS**

#### **2.01 GENERAL**

- A. In addition to material and equipment specified, provide incidental materials to affect a complete installation. Such incidental materials include solders, tapes, caulking's, mastics, gaskets, and similar items.
- B. Materials and equipment shall be uniform throughout the installation. Equipment of the same type shall be of the same manufacturer. Materials and equipment shall be new.

**PART 3 EXECUTION****3.01 EXAMINATION OF SITE**

- A. Examine the site and become familiar with conditions that may affect the work covered by this Division of the Specifications.
- B. Arrange to meet with the Owner at the job site before the work is started and discuss with them the various phases of the work and the procedure and preparation for testing and adjusting the systems.
- C. The general arrangement and location of piping ductwork, apparatus, etc., is shown on the Drawings or herein specified. Minor changes may be necessary to accommodate other work, new or existing, that may conflict with this work. Install this work in harmony with these trades and fully coordinate work.
- D. Visit the site of the work, take measurements, examine areas where work is to be performed and get such other information necessary for proper execution of the work. Ascertain and check conditions with the Drawings and Specifications, other trades, existing conditions and by what means the work is to be performed. No allowance shall subsequently be made for extra expense due to failure or neglect to make such examination and correlation. Where revisions or changes in the existing work are required to permit the installation of new work, they shall be made at no additional cost to the Owner. No allowance shall be subsequently made for error or omission.

**3.02 ACCURACY OF DATA**

- A. The Drawings indicate the general arrangement and location of piping, ducts, and equipment. Should it be necessary to deviate from arrangement or location indicated in order to meet architectural conditions or site conditions, or due to interference with other work, make such deviations as offsets, rises and drops in piping and ducts that may be necessary, whether shown or not, without extra expense to the Owner. Extreme accuracy of the data given herein and on the Drawings is not guaranteed. The Drawings and Specifications are for the assistance and guidance of this Section and exact locations, distances, and elevations shall be governed by actual site conditions.

**3.03 COORDINATION ITEMS**

- A. Coordinate mechanical work with that of other trades in order to:
  - 1. Avoid interferences between general construction, mechanical, electrical, structural and other specialty trades.
  - 2. Maintain clearances and advise other trades of clearance requirements for operation, repair, removal and testing of mechanical equipment.
  - 3. Indicate aisle-ways and access-ways required on coordinated shop drawings for roof equipment area, mechanical equipment rooms, data and telecomm rooms, corridors, ceiling spaces, shafts, corridors, ceiling space, laboratories, etc.
- B. Understanding of Work:
  - 1. Study, examine, and compare of the contract documents, including drawings and specifications. The Subcontractor shall have a full understanding of how the work in this part is scheduled, phased, and installed with work of other trades.
  - 2. Include in this installation piping, ductwork, devices, and equipment that are necessary for complete and operating systems as specified and as required.
  - 3. Connect piping and ductwork from fixtures, outlets, and devices full size to the nearest suitable main or riser.
  - 4. Certain installations may be presented as typical, and full details are not repeated for each

- case. Subcontractor shall provide complete installation as if full details apply to each and every case, and make adjustments to typical details to suit each specific installation as part of the basic work.
5. Installation of work presented on the diagrams are applicable to the plans, and work depicted on the plans are applicable to the diagrams.
  6. If there is a discrepancy in the drawings or specifications, the contractor shall figure the work based on the most stringent requirements to complete the installation and obtain clarification from the Architect before installation.
- C. Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
1. Coordinate mechanical systems, equipment, and materials installation with other building components.
  2. Verify dimensions by field measurements.
  3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
  4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
  5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
  6. Where mounting heights are not detailed or dimensioned, install systems, materials and equipment to provide the maximum headroom possible. Work shall be above ceilings or ceiling line.
  7. Coordinate installation and connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
  8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Coordinate with individual system requirements.
  9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
  10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as is practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
  11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
  12. Coordinate with the locations of electrical panels and avoid installing piping and ductwork over them. Electrical panels are purposely located and have priority for location. The contractor is responsible for required piping and ductwork offsets to ensure that the panels are located as designed and for other conditions.
  13. Perform system modification recommended by Test and Balance Agency after recommendations are accepted by the Building Owner.

### **3.04 WORKMANSHIP AND SUPERVISION**

- A. Measurements: Materials installed shall be to exact field measurements.
- B. The installation depicted on the Drawings is designed to fit tightly into work under other Sections

or Divisions. It is the essence of this Contract that work be completely coordinated with other Sections or Divisions, and that locations of pipes and ducts be exactly determined in the field and cleared with other Sections or Divisions before the installation of these items is begun. No extra compensation will be made for failure to observe this clause.

- C. Adequate clearance for access to operable devices and automatic devices and for access to lubrication points shall be maintained in portions of the work including ductwork and piping installed on the roof. Tripping hazards shall be avoided. All valve handles shall be installed in a horizontal position.
- D. Provide architectural access doors where shown and where required for access to equipment and operable devices.
- E. Gauges, thermometers, and other indicating devices shall be installed so that they can be easily read from the floor.
- F. All operable devices such as valves, circuit setters, strainers, and all HVAC related devices, etc., shall be easily accessible from a normal placement of a portable step ladder to operate, to maintain, and to obtain measurement data.

### **3.05 INSTALLATION**

- A. Manufacturer's Directions: Follow manufacturer's directions covering points not shown on the drawings or specified herein. Manufacturer's directions do not take precedence over drawings and Specifications. Where these are in conflict with the drawings and Specifications, notify the Project Manager for clarification before installing the work.
- B. Carpentry, Cutting, Patching, and Core Drilling:
  - 1. Provide carpentry, cutting, patching, and core drilling required for installation of material and equipment specified in this Division.
  - 2. No penetrations shall be sleeved, cut, or core drilled through concrete construction without a submittal indicating exact locations and sizes and specific written approval from the Owner or unless specifically shown on the Structural Drawings.
  - 3. It is the Subcontractor's responsibility to accurately size and locate openings through the structure. The dimensions shown on the Structural Drawings are for general information only. Provide specific sizes, dimensions, requirements, etc.
- C. Waterproof Construction:
  - 1. Maintain waterproof integrity of penetrations of materials intended to be waterproof. Provide flashings at exterior roof penetrations. Caulk penetrations of foundation walls and floors watertight. Provide membrane clamps at penetrations of waterproof membranes.
  - 2. Provide waterproof NEMA 3R enclosures for equipment or devices mounted outside or otherwise exposed to the weather.
- D. Sleeves, Stubs, and Slab Penetrations: Division 23, Section 230529, Hangers and Supports for HVAC Piping and Equipment.
- E. Painting of Mechanical Equipment and Hardware:
  - 1. Provide moisture resistant paint for exterior painting.
  - 2. Colors shall be as shown on the drawings unless specified.
  - 3. Comply with individual Sections for other equipment to be painted.
  - 4. Repair damaged galvanizing, paint, or coatings. Use Z.R.C. (no known equal) cold galvanized compound for galvanized repairs.
- F. Concrete Equipment Bases:
  - 1. All equipment located on concrete floor inside the building or on grade outside the building, shall be mounted on a concrete base. The concrete base shall be four inches high and shall extend six inches beyond the edge of equipment base unless indicated otherwise on drawings.

2. Coordinate concrete bases: Concrete bases indicated on Architectural or Structural drawings are specified in other Divisions. Concrete bases not on Architectural or Structural drawings are requirements of this Division.

### **3.06 PROTECTION OF EQUIPMENT**

- A. Care shall be exercised during construction to avoid damage or disfigurement. Equipment shall be protected from dust and moisture prior to and during construction. The Subcontractor is cautioned that concrete finishing, painting, etc. in electrical rooms shall not proceed if unprotected equipment is installed.
- B. Where required or directed, construct temporary protection for equipment and installations for protection from dust and debris caused by construction.
- C. All protection shall be substantially constructed with the use of clean canvas, heavy plastic, visqueen, and plywood, as required, and made tight and dust proof as directed.
- D. The Subcontractor shall repair by spray or brush painting, after properly preparing the surface, scratches or defects in the finish of the equipment. Only identical paint furnished by the equipment manufacturer shall be used for such purposes.
- E. Failure of the Subcontractor to protect the equipment as outlined herein shall be grounds for rejection of the equipment and its installation.

### **3.07 LUBRICATION**

- A. All lubrication points shall be accessible. Where this is impossible, provision shall be made for lubrication at an accessible location. Where oil is used, an oil level indicator and capped, vented filling connection shall be provided and firmly mounted in an accessible space and shall be connected to the bearing with pipe(s) as required. Where grease is used for lubricant, the pipe shall have a suitable lubricating fitting installed at the accessible end. Equipment shall be thoroughly lubricated before operation and at time work is accepted.

### **3.08 SEALANTS**

- A. Completely seal duct, pipe and conduit penetrations through rated and non-rated walls.

### **3.09 TESTS**

- A. Upon completion of the mechanical construction work, perform tests and provide test reports as specified in this and other sections.
  1. All tests shall be made in the presence of a representative of the Project Manager. The application or interruption of mechanical utilities shall be programmed and directed by the Project Manager.
  2. The Subcontractor shall submit to the Project Manager 3 copies of test results, certified in writing, witnessed, signed and dated, immediately upon completion of work. Unsatisfactory condition revealed by these test results, or unsatisfactory methods of tests and/or testing apparatus and instruments, shall be corrected by the Subcontractor to the satisfaction of the Project Manager.
  3. The Project Manager reserves the right to require that the Subcontractor perform and repeat tests that are deemed necessary to complete or check the tests or the certified records of the Subcontractor during the course of the work. Correct unsatisfactory portion of its work that is revealed by the tests or that may be due to progressive deterioration during this period, unless the item in question was a direct specification.

### **3.10 COMMISSIONING**

- A. Commissioning is included as a part of the total package of quality assurance and quality control

for this project. Commissioning is to be integrated into the project as the process that oversees and verifies the functional performance of equipment, systems, and assemblies via observation and testing. Include coordination with and full participation in the commissioning process. Commissioning shall include but not be limited to field observations, factory and site tests, pre-start checks, start-up checks, functional test procedure review, functional testing, commissioning meetings, documentation, test interpretation, and deficiency correction. The details of these requirements are described in the above Sections and other referenced Sections and are hereby incorporated by reference into the work of this Division.

### **3.11 MAINTENANCE AND OPERATING INSTRUCTIONS AND TRAINING**

- A. At time of occupancy, arrange for manufacturer's representatives to instruct operating and maintenance personnel in the use of equipment requiring operating and maintenance. Arrange for personnel to be instructed at one time. Costs for this service shall be included in the Subcontract.
- B. Maintenance and operating instructions and training for Owner-furnished equipment will be provided by the equipment vendor. The Subcontractor shall be responsible for other equipment.

**END OF SECTION**

**SECTION 23 05 17**  
**SLEEVES AND SLEEVE SEALS FOR HVAC PIPING**

**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. Sleeves.
  - 2. Stack-sleeve fittings.
  - 3. Sleeve-seal systems.
  - 4. Grout.

**1.03 SUBMITTALS**

- A. Product Data: For each type of product indicated.

**PART 2 PRODUCTS**

**2.01 SLEEVES**

- A. Cast-Iron Wall Pipes:
  - 1. Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral water stop unless otherwise indicated.
- B. Galvanized-Steel-Pipe Sleeves:
  - 1. ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- C. Galvanized-Steel-Sheet Sleeves:
  - 1. 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

**2.02 STACK-SLEEVE FITTINGS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Smith, Jay R. Mfg. Co.
  - 2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
- B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
- C. Underdeck Clamp: Clamping ring with setscrews.

**2.03 SLEEVE-SEAL SYSTEMS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Advance Products & Systems, Inc.
  - 2. CALPICO, Inc.
  - 3. Metraflex Company
  - 4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing-element, designed for field assembly, for filling annular space between piping and sleeve.
  - 1. Sealing Elements: Interlocking links shaped to fit surface of pipe. Include type and

number required for pipe material and size of pipe.

- a. EPDM (-40 to 250 Deg F): Standard service applications.
- b. Nitrite (-40 to 250 Deg F): Hydro carbon service applications.
- c. Silicon (-67 to 400 Deg F): High temperature or fire seal applications.
2. Pressure Plates: Plastic. Include two for each sealing element.
  - a. Provide steel pressure plates for fire and high temperature applications.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements. Include one for each sealing element.
  - a. Provide 316 stainless steel connecting bolts and nuts in corrosive environments where chemicals are present.

## **2.04 GROUT**

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Non-shrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## **PART 3 EXECUTION**

### **3.01 SLEEVE INSTALLATION**

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough per sleeve seal manufacturer's recommendations to provide minimum 1-inch annular clear space between piping and concrete slabs and walls.
  1. Sleeves are not required for core-drilled holes, except where mechanical spaces or wet areas are above finished areas.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Penetration shall be made completely watertight.
  2. Using grout, seal the space outside of sleeves in slabs and walls.
- D. Install sleeves for pipes passing through interior partitions.
  1. Cut sleeves to length for mounting flush with both surfaces.
  2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors as indicated on architectural drawings at pipe penetrations. Seal pipe penetrations with firestop materials.

### **3.02 STACK-SLEEVE-FITTING INSTALLATION**

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
  1. Install fittings that are large enough to provide 1/4-inch annular clear space between



- sleeve and pipe or pipe insulation.
- 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Division 07 Section "Sheet Metal Flashing and Trim."
- 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
- 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
- 5. Using grout, seal the space around outside of stack-sleeve fittings.
- B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

### **3.03 SLEEVE-SEAL-SYSTEM INSTALLATION**

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### **3.04 SLEEVE AND SLEEVE-SEAL SCHEDULE**

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
    - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.
  - 2. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system or galvanized-steel-pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
    - b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system or galvanized-steel-pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 3. Concrete Slabs-on-Grade:
    - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system or galvanized-steel-pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
    - b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system or galvanized-steel-pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 4. Concrete Slabs above Grade:
    - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves or stack-sleeve fittings.
      - 1) Provide sleeve seals where sleeves are located in floors of mechanical or wet spaces over finished spaces.

- b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves or stack-sleeve fittings.
  - 1) Provide sleeve seals where sleeves are located in floors of mechanical or wet spaces over finished spaces.
- 5. Interior Partitions:
  - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
  - b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

**END OF SECTION**

**SECTION 23 05 53**  
**IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Equipment labels.
- B. Pipe labels.
- C. Valve tags.
- D. Duct labels.

**1.02 RELATED SECTIONS**

- A. Section 23 11 23 - Facility Natural-Gas Piping.
- B. Section 22 14 13 - Facility Storm Drainage Piping.

**1.03 REFERENCES**

- A. ASME A13.1 - Scheme for the Identification of Piping Systems.

**1.04 SUBMITTALS**

- A. 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.
- B. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for HVAC equipment, piping, valve and duct identification.
  - 1. Equipment Label Schedule: Provide a schedule of all equipment to be labeled with the proposed content for each label.
  - 2. Pipe Label Schedule: Provide a schedule of each piping system indicating a proposed nomenclature and location of all pipe markers.
  - 3. Valve Tag Schedule: Provide a proposed valve numbering scheme and schedule for each piping system. Tabulate valve number, piping system, system abbreviation as shown on tag, room or space location of valve, normal-operating position (open, closed, or modulating), and variations for identification. Mark valves intended for emergency shut-off and similar special uses.
  - 4. Duct Label Schedule: Provide a schedule of each duct system indicating a proposed nomenclature and location of all duct markers.
- C. Closeout Submittals: Record actual as built locations of valve tags and update schedules accordingly.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience
- B. Installer Qualifications: Company specializing in performing Work of this section with minimum five years documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging with labels clearly identifying product name

and manufacturer until ready for installation.

- B. Storage: Store materials in clean, dry area indoors until ready for installation.
- C. Handling: Protect materials and finish from damage during handling and installation.

#### **1.07 PRE-INSTALLATION MEETINGS**

- A. Convene minimum two weeks prior to commencing Work of this section.
- B. Review installation procedures and coordination required with related Work.
- C. Inspect and make notes of job conditions prior to installation:
  - 1. Record minutes of the conference and provide copies to all parties present.
  - 2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
  - 3. Installation of identification system shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

#### **1.08 SEQUENCING**

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

#### **1.09 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.

### **PART 2 PRODUCTS**

#### **2.01 MECHANICAL IDENTIFICATION GENERAL**

- A. General: Provide manufacturer's standard products of categories and types required for each application specified. For each identification type, provide all products from same manufacturer with same text, style, color, shape, and other identification features.
  - 1. Provide nameplates with the unit number on all mechanical equipment.
  - 2. Provide pipe identification labels including direction-of-flow arrows and with service indicated. All labels shall have background colors matched with specific service designation.
  - 3. Provide valve tag numbers on HVAC piping valves.
  - 4. Provide duct identification labels including direction-of-flow arrows and with service indicated. All labels shall have background colors matched with specific service designation.

#### **2.02 EQUIPMENT LABELS**

- A. Plastic Labels for Equipment (Indoor Application):
  - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick.
  - 2. Letter Color: Black
  - 3. Background Color: White
  - 4. Minimum Label Size: Length and width vary for required label content, but not less than 1 by 3

- inches.
- 5. Minimum Letter Size: 1/4 inch.
- 6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment (Outdoor Application):
  - 1. Material: MS-215 Max-Tek with printed graphics protected by a chemical and UV resistant MS-3000 top laminate.
  - 2. Letter Color: Black
  - 3. Background Color: White
  - 4. Minimum Label Size: Length and width vary for required label content, but not less than 1 by 3 inches.
  - 5. Minimum Letter Size: 1/4 inch.
  - 6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

### **2.03 SLEEVE-SEAL SYSTEMS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Advance Products & Systems, Inc.
  - 2. CALPICO, Inc.
  - 3. Metraflex Company (The).
  - 4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 1. Sealing Elements: Interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
    - a. EPDM (-40 to 250 Deg F): Standard service applications.
    - b. Nitrite (-40 to 250 Deg F): Hydro carbon service applications.
    - c. Silicon (-67 to 400 Deg F): High temperature or fire seal applications.
  - 2. Pressure Plates: Plastic. Include two for each sealing element.
    - a. Provide steel pressure plates for fire and high temperature applications.
  - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements. Include one for each sealing element.
    - a. Provide 316 stainless steel connecting bolts and nuts in corrosive environments where chemicals are present.

### **2.04 PIPE LABELS (INDOOR PIPING)**

- A. Provide labels for above ground piping located indoors, and not exposed to sunlight or a harsh environment.
- B. Pre-printed, color-coded, with lettering indicating service, and showing flow direction.
- C. Lettering shall be sub-surface printed and protected from direct contact by a layer of plastic. Markers with surface printed lettering will not be accepted.
- D. Pipe Labels for pipe O.D. less than 8 inches: MS-970 Coiled, semi rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive in contact with the pipe surface.
- E. Pipe Labels for pipe O.D. 8 inches and over: MS-970 Strap-on, semi rigid plastic to cover partial circumference of pipe and to attach to pipe with nylon ties
- F. Pipe Label Schedule:

Pipe O.D. (including insulation)	Marker Style	Marker Width	Lettering Height	Marker Type
1/4 inch to 3/8 inch	MS970-TM	3 inches	1/4 inch	Coil-on
1/2 inch to 1 inch	MS970-A	8 inches	1/2 inch	Coil-on
1-1/8 inch to 2- 1/4	inch MS970-B	8 inches	3/4 inch	Coil-on
2-3/8 inch to 3- 1/4	inch MS970-C	12 inches	1-1/4 inch	Coil-on
3-3/8 inch to 4- 1/2	inch MS970-D	12 inches	1-1/4 inch	Coil-on
4-5/8 inch to 5- 7/8	inch MS970-E	12 inches	1-1/4 inch	Coil-on
6 inch to 7-7/8 inch	MS970-FC	12 inches	1-1/4 inch	Coil-on
8 inch to 10 inch	MS970-G	24 inches	2-1/2 inch	Strap-on
Over 10 inch	MS970-H	32 inches	3-1/2 inch	Strap-on

B. Pipe Label Color Schedule:

Service	Lettering Color	Background Color
Chilled Water Piping	White	Green
Condenser Water Piping	White	Green
Heating Water Piping	White	Green
Steam Piping	White	Green
Steam Condensate	White	Green
Refrigerant Piping	Black	Orange

## 2.05 PIPE LABELS (OUTDOOR PIPING)

- A. Provide labels for above ground piping located outside, and exposed to sunlight or a harsh environment, the following product is specified.
- B. Pre-printed, color-coded, with lettering indicating service, and showing flow direction.
- C. Pipe markers shall be constructed of MS-995 Maxilar material. Pipe markers shall withstand direct contact with all process chemicals, operating temperatures up to 250 degrees F, and prolonged

exposure to direct sunlight.

- D. Pipe markers shall be constructed of printed 5 mil (0.005 inch) polyester and top laminated with MS1000 clear ultra violet and chemical resistant plastic film that is engineered to provide maximum durability of the printed legend. Markers shall be pre-coiled to wrap entirely around the circumference of pipe up to 10 inch outside diameter, and self-sealed with a strip of clear ultra violet and chemical resistant plastic film. Coiled markers shall seal to themselves, and not the pipe surface.
- E. Pipe Labels for pipe O.D. up to 10 inches: Shall be labeled with a single piece, pre-printed marker that wraps entirely around the circumference of the pipe, overlaps and seals to itself rather than adhere to the pipe surface.
- F. Pipe Labels for pipe O.D. 10 inches and greater: Shall be constructed of printed 5 mil (0.005 inch) polyester and top laminated with MS1000 clear ultra violet and chemical resistant plastic film that is pre-applied to an acrylic-faced, co-extruded ABS plastic carrier. Carrier shall have pre-formed legs running the entire length of the part to ensure marker remains straight and aligned with pipe. Flow direction shall be identified by application of a separate arrow label of same construction. Carriers shall be affixed to piping by means of two stainless steel straps that wrap entirely around the circumference of the pipe.

G. Pipe Label Schedule:

Pipe O.D. (including insulation)	Marker Style	Marker Width	Lettering Height	Marker Type
3/4 inch to 1 inch	MS995-A	8 inches	1/2 inch	Wraparound
1-1/8 inch to 2- 3/8 inch	MS995-B	8 inches	3/4 inch	Wraparound
2-1/2 inch to 4- 3/4 inch	MS995-D	12 inches	1-1/4 inch	Wraparound
5 inch to 7-7/8 inch	MS995-E	12 inches	1-1/4 inch	Wraparound
8 inch to 10 inch	MS995-J	12 inches	1-1/4 inch	Wraparound
Over 10 inch	MS995-MB	32 inches	2-1/2 inch	Carrier

H. Pipe Label Color Schedule:

Service	Lettering Color	Background Color
Chilled Water Piping	White	Green
Condenser Water Piping	White	Green
Heating Water Piping	White	Green
Steam Piping	White	Green
Steam Condensate	White	Green

Refrigerant Piping

Black

Orange

**2.06 VALVE TAGS**

- A. Valve Tags: Stamped or engraved with 1/4 inch letters for piping abbreviation and 1/2 inch numbers.
  - 1. Tag Material: Brass, 0.032 inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Background Color: Natural brass.
  - 3. Letter Color: Black.
  - 4. Tag Size: 1-1/2 inches, round.
  - 5. Fasteners: Brass S-Hooks and Jack Chain.
- B. Valve Tags: For outdoor labeling of process valves.
  - 1. Material: MS-215 Max-Tek with printed graphics protected by a chemical and UV resistant MS-3000 top laminate, and having stainless steel grommet protected predrilled holes with for attachment hardware.
  - 2. Background Color: To match pipe label color by system.
  - 3. Letter Color: Either white or black for best contrast to background color.
  - 4. Tag Size: Minimum 1-1/2 inches.
  - 5. Fasteners: Stainless steel S-Hooks and stainless steel Jack Chain.

**2.07 DUCT LABELS (NON-PLENUM SPACE)**

- A. Pre-printed, color-coded, with lettering indicating associated equipment, service, and showing flow direction.
  - 1. Contents: Include identification of duct service using same system designation as used on Drawings and an arrow indicating flow direction. On each label, prefix the system designation with the associated equipment number (example: AHU-1 SUPPLY AIR).
  - 2. Material: MS900 vinyl with pressure sensitive acrylic adhesive backing.
  - 3. Marker Size: 2-1/4 inch high, with length to suit required label content.
  - 4. Lettering Size: Minimum 1-1/2 inches high
  - 5. Direction-of-Flow Arrows: Separate unit for each duct label to indicate flow direction.
  - 6. Arrow Marker Size: 2-1/4 inch by 6-1/2 inches.
- B. Duct Label Color Schedule:

Service	Lettering Color	Background Color
Supply Air	White	Green
Exhaust Air	Black	Yellow
Return Air	White	Blue
Relief Air	White	Blue
Outside Air	White	Blue

**2.08 DUCT LABELS (PLENUM SPACE)**

- A. Pre-printed, color-coded, with lettering indicating associated equipment, service, and showing flow direction.
  - 1. Contents: Include identification of duct service using same system designation as used on Drawings and an arrow indicating flow direction. On each label, prefix the system designation with the associated equipment number (example: AHU-1 SUPPLY AIR).



2. Material: MS-4000 1.6 mil aluminum with pressure sensitive adhesive backing. Meets NFPA 101 Life Safety Code for class A materials.
3. Marker Size: 2-1/4 inch high, with length to suit required label content.
4. Lettering Size: Minimum 1-1/2 inches high
5. Direction-of-Flow Arrows: Separate unit for each duct label to indicate flow direction.
6. Arrow Marker Size: 2-1/4 inch by 6-1/2 inches.

B. Duct Label Color Schedule:

Service	Lettering Color	Background Color
Supply Air	White	Green
Exhaust Air	Black	Yellow
Return Air	White	Blue
Relief Air	White	Blue
Outside Air	White	Blue

## 2.09 CEILING TACKS

- A. Provide steel ceiling tacks with a color-coded head 3/4 inch diameter and a 1.5 inch serrated shank.
  1. Provide ceiling tacks in acoustical tile ceilings to locate equipment, valves or dampers that require regular maintenance or are part of a Life Safety System.
  2. Tacks shall be color coded as follows (coordinate with Owner):
    - a. Yellow - HVAC equipment
    - b. Red - Life Safety (fire dampers, sprinkler valves, etc.)
    - c. Green - Plumbing Valves
    - d. Blue - Heating/Cooling Valves

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Install identifying devices after completion of coverings and painting.
- C. 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. For labels that are installed using pressure-sensitive adhesives, clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.
- C. For pipe markers that are pre-coiled or strap-on type and do not adhere directly to the piping, no surface preparation is necessary.

### 3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Equipment Labels:
  1. Install or permanently fasten labels on each major item of mechanical equipment.
  2. Locate equipment labels where accessible and visible.

- C. Pipe Labels: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
- D. Valve Tags: Install tags on all shut-off valves and control devices in piping systems, except valves within factory-fabricated equipment units.
- E. Duct Labels: Locate labels where ducts enter into and exits from concealed spaces or is concealed by removable ceiling system as follows:
  - 1. Near penetrations and on both sides of walls, floors, ceilings, and inaccessible enclosures.
  - 2. At access doors, manholes, and similar access points that permit view of concealed duct.
  - 3. Near major equipment items and other points of origination and termination.
  - 4. Spaced at maximum intervals of 50 feet along each run.
  - 5. Mark location of equipment or valves located above ceilings with identifying ceiling tacks to help in identification for maintenance.

#### **3.04 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

#### **END OF SECTION**

**SECTION 23 05 93  
HVAC TESTING ADJUSTING AND BALANCING**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. All Division 23 specification sections, drawings, and general provisions of the contract apply to work of this section, as do other documents referred to in this section.

**1.02 SCOPE OF WORK**

- A. The building Owner will approve a certified testing, adjusting, and balancing contractor appointed by the mechanical contractor. (Referred to as TAB work – Testing, Adjusting, and Balancing)

**1.03 PREPARATION AND COORDINATION REQUIREMENTS – GENERAL**

- A. Shop drawings, submittal data, up-to-date revisions, change orders, and other data required for planning, preparation, and execution of the TAB work shall be provided to the TAB Agency no later than 30 days prior to the start of TAB work.
- B. System installation and equipment startup shall be complete prior to the TAB Agency's being notified to begin.
- C. The building control system shall be complete and operational. The Building Control system (sub)contractor shall install all necessary computers and computer programs, and make these operational. Assistance shall be provided as required for reprogramming, coordination, and problem resolution.
- D. All test points, balancing devices, identification tags, etc. shall be accessible and clear of insulation and other obstructions that would impede TAB procedures.
- E. Qualified installation or startup personnel shall be readily available for the operation and adjustment of the systems. Assistance shall be provided as required for coordination and problem resolution.

**1.04 PREPARATION AND COORDINATION REQUIREMENTS – HVAC CONTROLS**

- A. Written notice shall be submitted through the General Contractor to the Architect-Engineer stating that the Control System is operating and controlling the HVAC System. This letter is to be provided to the DECA Project Manager and the TAB Agency prior to any balancing.
- B. The Contractor/Control (sub)contractor shall have entered all data needed for the TAB Agency to begin work.
- C. The Contractor/Control (sub)contractor shall be available to correct any problems that the TAB Agency may encounter with the systems.
- D. All costs for additional work by the TAB Agency due to the Contractor's failure to comply with the above shall be paid by the Contractor and any subcontractor(s) for HVAC controls.

**1.05 PREPARATION AND COORDINATION REQUIREMENTS – MECHANICAL**

- A. Written notice shall be submitted through the General Contractor to the Architect stating that the HVAC system is operational and ready for the TAB Agency. This letter is to be provided to the DECA Project Manager and the TAB Agency prior to any balancing.
- B. The Contractor/Mechanical subcontractor shall have proved all units operational and all air outlets in the full open position.
- C. The Contractor/Mechanical subcontractor shall be available to correct any problems that the TAB Agency might have with any equipment or systems.
- D. The Contractor/Mechanical subcontractor shall furnish and install any replacement sheaves,

pulleys and drive belts required for flow adjustments, as determined by the TAB Agency. Adjustable sheaves shall be selected so that the final adjustment position is in the middle third of the total adjustment range.

- E. All costs for additional work by the TAB Agency due to the Contractor's failure to comply with the above shall be paid by the Contractor and any subcontractor(s) for mechanical work.

#### **1.06 PREPARATION AND COORDINATION REQUIREMENTS – DUCTWORK**

- A. Ductwork air leakage testing shall be performed by the TAB Agency.
- B. The ductwork/ sheet metal subcontractor shall promptly correct any related problems discovered by the leakage tests.
- C. All costs associated with retesting and/or delays or other problems which impede the TAB Agency from performing such testing shall be paid by the contractor and any subcontractor(s) for ductwork.

#### **1.07 WORK BY TAB AGENCY**

- A. The work included in the remainder of this section consists of furnishing labor, instruments, and tools required in testing, adjusting and balancing the HVAC systems, as described in these specifications or shown on accompanying drawings. Services shall include checking equipment performance, taking the specified measurements, and recording and reporting the results. This work shall be performed by the TAB Agency under direct contract to the owner. The remainder herein is also for the information of the Contractor and all subcontractors.
- B. The items requiring testing, adjusting, and balancing include the following:
  - 1. Air Systems:
    - a. All ERUs
    - b. All HPs
    - c. All ACCUs
    - d. All supply fans
    - e. All return fans
    - f. All relief fans
    - g. All exhaust fans
    - h. Zone branch and main ducts
    - i. Diffusers, grilles, and registers
    - j. All fan coils
  - 2. Hydronic Systems:
    - a. All pumps
    - b. System mains and branches
    - c. All boilers
    - d. All chillers
    - e. All coils

#### **1.08 QUALIFICATIONS**

- A. Agency qualifications: The TAB Agency shall be a current member of a nationally recognized balance organization ("National Organization"). This Organization shall provide the owner with National Guarantee document certifying the work of the TAB Agency. Acceptable organizations are Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB).
  - 1. The selected TAB Agency must provide proof of certification for the total project (air, water, sound, vibration, etc.).
  - 2. The selected TAB Agency shall be provided access to computers, cables or any software needed to operate the building control system during the balancing phase.

- B. All work shall be in accordance with the latest edition of the National Standards, as published by the National Organization affiliated with the TAB Agency.

#### **1.09 SUBMITTALS**

- A. Qualifications: The TAB Agency shall submit a company resume listing personnel and project experience in air and hydronic system balancing and a copy of the agency's test and balance engineer (TBE) certificate. Certification in noise, vibration, and air quality shall be submitted as the job requires. At minimum, the balance technician shall possess their technician certification.
- B. Procedures and agenda: The TAB Agency shall submit the TAB procedures and agenda proposed to be used.

#### **1.10 REPORTS**

- A. Final TAB Report – The TAB Agency shall submit the final TAB report for review by the engineer. All equipment including but not limited to fans, outlets, traverses, static pressure profiles, pumps, coils, etc. shall be identified in the report. The report must also include, at minimum, electronic drawings that correspond to all test points for additional report clarification. The TAB Agency shall submit an "National Project Performance Guaranty" assuring that the project systems were tested, adjusted and balanced in accordance with the project specifications and National Standards. Submit electronic copies of the Final TAB Report to the Architect-Engineer, and the Project Manager from the Division of Engineering and Contract Administration. A maximum of three (3) additional hard copies shall be submitted on request. Payments for the TAB work shall be contingent upon the proper submittal and approval of the TAB reports.

#### **1.11 DEFICIENCIES**

- A. Any deficiencies in the installation or performance of a system or component observed by the TAB Agency shall be brought to the attention of the appropriate responsible person. Also notify the mechanical project representative from the Division of Engineering and Contract Administration.
- B. The work necessary to correct items on the deficiency listing shall be performed and verified by the affected contractor before the TAB Agency returns to retest. Unresolved deficiencies shall be noted in the final report.

### **PART 2 INSTRUMENTATION**

#### **2.01 STANDARDS**

- A. All instruments used for measurements shall be accurate and calibrated. Calibration and maintenance of all instruments shall be in accordance with the requirements of the National Standards.

### **PART 3 EXECUTION**

#### **3.01 GENERAL**

- A. The specific systems shall be reviewed and inspected for conformance to design documents. Testing, adjusting and balancing on each identified system shall be performed. The accuracy of measurements shall be in accordance with national Standards. Adjustment tolerances shall be + or – 5% unless otherwise stated.
- B. Equipment settings, including manual damper quadrant positions, manual valve indicators, fan speed control levers, and similar controls and devices shall be marked to show final settings.
- C. All information necessary to complete a proper TAB project and report shall be per National

Organization's standards unless otherwise noted. The descriptions for work required, as listed in this section, are guides to the minimum information needed.

**3.02 AIR SYSTEMS**

- A. The TAB Agency shall verify that all ductwork, dampers, grilles, registers, and diffusers have been installed per design and set in the full open position. The TAB Agency shall perform the following TAB procedures in accordance with the National Standards.

**3.03 HYDRONIC SYSTEMS**

- A. The TAB Agency shall, as applicable, confirm that all hydronic equipment, piping, and coils have been filled and purged; that strainers have been cleaned; and that all balancing valves (except bypass valves) are set full open. The TAB Agency shall perform the following testing and balancing functions in accordance with the National Standards.

**END OF SECTION**

**SECTION 23 07 19  
HVAC PIPE INSULATION**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Related Documents:
  - 1. Review these documents for coordination with additional requirements and information that apply to work under this Section.
- B. Section Includes:
  - 1. Piping insulation.
  - 2. Jackets and accessories.

**1.02 REFERENCES**

- A. General:
  - 1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
  - 2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.
- B. ASTM International:
  - 1. ASTM-B-209           Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
  - 2. ASTM-C-195           Standard Specification for Mineral Fiber Thermal Insulating Cement
  - 3. ASTM C 196           Standard Specification for Expanded or Exfoliated Vermiculite Thermal Insulating Cement
  - 4. ASTM-C-449           Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
  - 5. ASTM-C-533           Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
  - 6. ASTM C534 / C534M   Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
  - 7. ASTM-C-547           Standard Specification for Mineral Fiber Pipe Insulation
  - 8. ASTM-C-552           Standard Specification for Cellular Glass Thermal Insulation
  - 9. ASTM C553           Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
  - 10. ASTM-C-578          Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
  - 11. ASTM-C-610          Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation
  - 12. ASTM-E-84 Standard Test Method for Surface Burning Characteristics of Building Material.
  - 13. ASTM C 450          Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging
  - 14. ASTM C 921          Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
  - 15. ASTM B 209          Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
  - 16. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
- C. Code of Federal Regulations 20-CFR-1910.7 Definitions and Requirements for A Nationally

- Recognized Testing Laboratory (NRTL)
- D. National Fire Protection Association NFPA-90A & NFPA-255 Surface Burning Characteristics of Building Materials
- E. Underwriters Laboratories UL-723 Surface Burning Characteristics of Building Materials

### **1.03 SUBMITTALS**

- A. Subcontractor shall submit the product description, list of materials and thickness for each service, and at each location.

### **1.04 QUALITY ASSURANCE**

- A. LEED Submittals:
  - 1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
- B. Subcontractor shall assure applicator is a company specializing in piping insulation application with at least 3-years relevant experience.
- C. Fire Hazard: Provide insulation, jackets, facings adhesives and accessories acceptable to the State Fire Marshal, and meeting the requirements of NFPA 90A. Meet the following hazard classifications stated in accordance with U.L. Test Method of Fire Hazard -Classifications of Building Materials, No. 723:
  - 1. Flame-spread: Maximum 25.
  - 2. Fuel Contributed: Maximum 50.
  - 3. Smoke Developed: Maximum 50.S

## **PART 2 PRODUCTS**

### **2.01 INSULATION MATERIALS**

- A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:
  - 1. Preformed Pipe Insulation: Comply with ASTM C 547, Type I, with factory-applied, all-purpose, vapor-retardant jacket.
  - 2. Blanket Insulation: Comply with ASTM C553, Type II, without facing.
  - 3. Fire-Resistant Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
    - a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 4. Vapor-Retarder Mastics: Fire and water-resistant. Comply with MIL-C 19565C, Type II.
    - a. For indoor applications, use mastics that have a VOC content of <Insert value> g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 5. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
  - 6. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.
  - 7. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
- B. Cellular-Glass Insulation: Inorganic, foamed or cellulated glass, annealed, rigid, hermetically sealed cells, incombustible.
  - 1. Preformed Pipe Insulation, without Jacket: Comply with ASTM C 552, Type II, Class I.
  - 2. Preformed Pipe Insulation, with Jacket: Comply with ASTM C 552, Type II, Class 2.
  - 3. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
    - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



- C. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in performing insulation to cover valves, elbows, tees, and flanges.
- D. Elastomeric Cellular Thermal Insulation: Closed cell, fiber-free elastomeric foam, mold resistant, formaldehyde-free, low VOC and nonparticulating.
  - 1. Sheets: Comply with ASTM C 534, Type II – Sheet Grade 1, ASTM E84, NFPA 255, UL 723, NFPA 90A, 90B.
  - 2. For above ground installation only.
  - 3. For outdoor installation, a weather – resistant protective finish shall be provided per manufacturer's recommendation.

## **2.02 FIELD-APPLIED JACKETS**

- A. General: ASTM C 921, Type I, unless otherwise indicated.
- B. Foil and Paper Jacket: Not acceptable.
- C. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming.
  - 1. Adhesive: Compatible with PVC jacket, and recommended by insulation material manufacturer.
    - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. PVC Jacket Color: White
  - 3. PVC Jacket Color: Color-code piping jacket as determined by existing conditions.
  - 4. Not to be used for outdoors.
- D. Heavy PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 30-mil (0.75 mm) thick, high-impact, ultraviolet-resistant PVC.
  - 1. Shapes: 45 and 90-degree, short and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
  - 2. Adhesive: Compatible with PVC jacket, and recommended by insulation material manufacturer.
    - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Not to be used for outdoors.
- E. Aluminum Jacket: Aluminum roll stock, ready for shop or field cutting and forming to indicated sizes. Comply with ASTM B 209 (ASTM B 209M), 3003 alloy, H-14 temper.
  - 1. Finish and Thickness: Smooth finish, 0.010 (0.25 mm) inch thick.
  - 2. Moisture Barrier: 1-mil thick, heat-bonded polyethylene and kraft paper.
  - 3. Elbows: preformed 45 and 90-degree, short and long-radius elbows; same material, finish, and thickness as jacket.
  - 4. Acceptable for outdoor installation.

## **2.03 ACCESSORIES AND ATTACHMENTS**

- A. Bands: stainless steel ASTM A666, Type 304, 3/4 inch (20 mm) wide; 0.02 inch (0.050 mm) thick.

## **2.04 SEALANTS**

- A. Joint sealants, PVC and metal jacket flashing sealants: For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

**PART 3 EXECUTION****3.01 EXAMINATION**

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.02 PREPARATION**

- A. Install materials after piping has been tested and approved.
- B. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

**3.03 GENERAL APPLICATION REQUIREMENTS**

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.
- B. Refer to schedules at the end of this Section for material, form, jacket, and thickness required for each piping system insulation requirements.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften or otherwise attack insulation or jacket when in either wet or dry state.
- D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.
- E. Apply multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Seal joints and seams with vapor-retardant mastic on insulation indicated to receive a vapor retardant.
- H. Keep insulation materials dry during application and finishing.
- I. Apply insulation with tight longitudinal seams and end joints. Bond the seams and joints with adhesive recommended by the insulation material manufacturer.
- J. Apply insulation with the least number of joints practical.
- K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retardant integrity, unless otherwise indicated. Refer to special instruction for applying insulation over fittings, valves, and specialties.
- L. Hangers and Anchors: Where vapor retardant is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retardant mastic.
  - 1. Apply insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor retardants are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retardant integrity.
  - 3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.
- M. Insulation Terminations: For insulation where vapor retardants are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retardant integrity.

- N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.
- O. Apply insulation with integral jackets as follows:
  - 1. Pull jacket tight and smooth.
  - 2. Circumferential Joints: Cover with 3 inches (75 mm) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4-inches o.c.
  - 3. Longitudinal Seams: Overlap jacket seams at least 1 1/2 inches (38 mm). Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4-inches o.c.
  - 4. Exception: Do not staple longitudinal laps on insulation having a vapor retardant.
  - 5. Vapor-retardant mastics: Where vapor retardants are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
  - 6. At penetrations in jackets for thermometers and pressure gauges, fill and seal voids with vapor-retardant mastic.
- P. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
  - 1. Seal penetrations with vapor-retardant mastic.
  - 2. Apply insulation for exterior applications tightly joined to interior insulation ends.
  - 3. Extend metal jacket for exterior insulation occurring outside of roof flashing at least 2-inches below the top of the roof flashing.
  - 4. Seal sheet metal jacket to roof flashing with vapor-retardant mastic.
- Q. Exterior Wall Penetrations: For penetration of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retardant mastic.
- R. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.
- S. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions
  - 1. Firestopping and fire-resistive joint sealers are specified in Division 07 "Penetration Firestopping".
  - 2. Floor Penetrations: Apply insulation continuously through floor assembly.
  - 3. For insulation with vapor retardants, seal insulation with vapor-retardant mastic where floor supports penetrate vapor retardant.

### **3.04 MINERAL-FIBER INSULATION APPLICATION**

- A. Apply insulation to straight pipes and tubes as follows:
  - 1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
  - 2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20-feet (4.5 to 6 m) to form a vapor retarder between pipe insulation segments.
  - 3. For insulation with factory-applied jackets, secure laps with outward clinches staples at 6 inches o.c.
  - 4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.
- B. Apply Insulation to flanges as follows:
  - 1. Apply preformed pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
  - 3. Fill voids between inner circumference of flange insulation and outer circumference of

- adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.
- C. Apply insulation to fittings and elbows as follows:
1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
  2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
  3. Cover fittings with heavy PVC covers. Overlap PVC covers on pipe insulation jackets at least 1 inch (25 mm) at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
- D. Apply insulation to valves and specialties as follows:
1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
  2. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
  3. Apply insulation to flanges as specified for flange insulation application.
  4. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
  5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

### **3.05 CELLULAR-GLASS INSULATION APPLICATION**

- A. Apply insulation to straight pipes and tubes as follows:
1. Secure each layer of insulation to pipe with bands without deforming insulation.
  2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic.
  3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6-inches o.c.
  4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.
- B. Apply insulation to flanges as follows:
1. Apply preformed pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of the same thickness as pipe insulation.
  4. Apply insulation to fittings and elbows as follows:
  5. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instruction.
  6. When premolded sections of insulation are not available, apply mitered sections of cellular-glass insulation. Secure insulation materials with bands.
  7. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets

as least 1 inch (25 mm) at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

- C. Apply insulation to valves and specialties as follows:
  - 1. Apply premolded segments of cellular-glass insulation or glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
  - 2. Apply insulation to flanges as specified for flange insulation application.
  - 3. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
  - 4. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

### **3.06 PREFORMED ELASTOMERIC CELLULAR THERMAL INSULATION APPLICATION**

- A. Apply insulation to straight pipes and tubes as follows:
  - 1. Install pipe insulation by slitting tubular sections and applying onto pipes. Seams and butt joints shall be adhered and sealed using Armaflex 520 adhesive
  - 2. All edges shall be clean-cut. Rough or jagged edges shall not be permitted.
- B. Apply insulation to valves, flanges and fittings as follows:
  - 1. Insulate with the same insulation thickness as the adjacent piping. Seams and butt joints shall be adhered and sealed with Armaflex 520 adhesive.
  - 2. All edges shall be clean-cut. Rough or jagged edges shall not be permitted.
- C. Outdoor insulation shall be protected as follows:
  - 1. Furnish aluminum jacket and aluminum fitting covers.
  - 2. All jackets shall have the seams located below the horizontal plane of the pipes but not at the bottom of the pipe.
- D. Indoor insulation shall be protected as follows:
  - 1. Furnish PVC jacket and PVC aluminum fitting covers.
  - 2. All jackets shall have the seams located below the horizontal plane of the pipes but not at the bottom of pipe.

### **3.07 FIELD-APPLIED JACKET APPLICATION**

- A. Apply PVC jacket where indicated, with 1 inch (25 mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
- B. Apply metal jacket where indicated, with 2-inch (50 mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel band 12 inches (300 mm) o.c. and at end joints.
- C. Insulation and jacket for cold pipes shall include wicks to direct possible condensation to outside the jacket. The product shall be Knauf PermaWick or equal.
- D. Indoor, Concealed Applications: Insulated pipes conveying fluids above or below ambient temperature shall have standard jackets, with or without vapor barrier, factory-applied or field-applied. Insulate fittings, joints and valves with insulation of like material and thickness as adjoining pipe, and finish with glass cloth and adhesive. PVC jackets shall be used.
- E. Indoor, Exposed Applications: For pipe exposed in mechanical equipment rooms or in finished spaces, insulate as for concealed applications. Finish with canvas jacket; size for finish painting. PVC jackets shall be used.
- F. Exterior Applications: Provide vapor-barrier jackets. Cover with aluminum jackets with seams

located below the horizontal plane of the horizontal piping route. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and cover with aluminum jackets.

- G. Buried Piping: Provide factory-fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt-impregnated open-mesh glass fabric, with 0.001 inch thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

### **3.08 PIPING SYSTEM APPLICATIONS**

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment.
  - 1. Flexible connectors.
  - 2. Vibration control devices.
  - 3. Fire-suppression piping.
  - 4. Drainage piping located in crawl spaces, unless otherwise indicated.
  - 5. Below-grade piping, unless otherwise indicated.
  - 6. Chrome-plated pipes and fittings, unless potential for personal injury.
  - 7. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

### **3.09 INSULATION APPLICATION SCHEDULE, GENERAL**

- A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.
- B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

### **3.10 INTERIOR INSULATION APPLICATION SCHEDULE**

- A. Service: Domestic and Industrial hot water. 203.2 mm
  - 1. Operating Temperature: 60 to 140 deg F (15.6 to 60 deg C).
  - 2. Insulation Material: Mineral-fiber
  - 3. Insulation Thickness: Apply the following insulation thicknesses:
    - a. Copper Pipe, Up to 2 inches (50.8 mm): 1 inch (25 mm) Insulation
  - 4. Field-Applied Jacket: PVC
  - 5. Vapor Retarder Required: Yes
- B. Service: Heating hot-water supply and return.
  - 1. Operating Temperature: 100 to 200 deg F (38 to 93 deg C).
  - 2. Insulation Material: Mineral-fiber
  - 3. Insulation Thickness: Apply the following insulation thicknesses:
    - a. Steel Pipe, Up to 2 inches (50.8 mm): 1 inch (25 mm) Insulation
    - b. Copper Pipe, Up to 2 inches (50.8 mm): 1 inch (25 mm) Insulation
    - c. Steel Pipe, 2 1/4 inches (57.2 mm) to 6 inches (152.4 mm): 1 1/2 inch (38 mm) Insulation
    - d. Copper Pipe, 2 1/4 inches (57.2 mm) to 6 inches (152.4 mm): 1 1/2 inch (38 mm) Insulation
  - 4. Field-Applied Jacket: PVC
  - 5. Vapor Retarder Required: Yes
- C. Service: Steam and Condensate:
  - 1. Operating Temperature: 450 deg F (232 deg C) and lower
  - 2. Insulation Material: Mineral-fiber or Calcium Silicate
  - 3. Insulation Thickness: Apply the following insulation thicknesses:

- a. Steel Pipe, Steam Up to 2 inches (50.8 mm): 1 1/2 inch (38 mm) Insulation
- b. Steel Pipe, Steam 2 1/4 inches (57.2 mm) to 4 inches (101.6 mm): 3 inches (75 mm) Insulation
- c. Steel Pipe, Condensate Up to 2 inches (50.8 mm) : 1 1/2 inch (38 mm) Insulation
- 4. Field-Applied Jacket: Aluminum
- 5. Vapor Retarder Required: No

### 3.11 EXTERIOR INSULATION APPLICATION SCHEDULE

- A. This application schedule is for aboveground insulation outside the building.
- B. Service: Domestic, industrial and DI Water.
  - 1. Operating Temperature: 60 to 140 deg F (15 to 60 deg C).
  - 2. Insulation Material: Mineral-fiber
  - 3. Insulation Thickness: Apply the following insulation thicknesses:
    - a. Copper pipe, All sizes: 1 inch (25 mm) Insulation
    - b. Polypropylene Pipe 1 inch (25 mm) Insulation
  - 4. Field-Applied Jacket: Aluminum for outdoor
  - 5. Vapor Retarder Required: Yes
- C. Service: Chilled-water supply and return.
  - 1. Operating Temperature: 35 to 75 deg F (2 to 24 deg C).
  - 2. Insulation Material: Mineral-fiber or closed-cell cellular
  - 3. Insulation Thickness: Apply the following insulation thicknesses:
    - a. Steel pipe, All sizes: 1 1/2 inch (38 mm) Insulation, 1" for cellular
    - b. Copper Pipe, All sizes: 1 1/2 inch (38 mm) Insulation, 1" for cellular
  - 4. Field-Applied Jacket: Aluminum for outdoor, PVC for indoor
  - 5. Vapor Retarder Required: Yes
- D. Service: Heating hot-water supply and return.
  - 1. Operating Temperature: 100 to 220 deg F (38 to 104 deg C)
  - 2. Insulation Material: Mineral Fiber
  - 3. Insulation Thickness: Apply the following insulation thicknesses:
    - a. Steel Pipe, All sizes: 1 1/2 inch (38 mm) Insulation
    - b. Copper Pipe, All sizes: 1 1/2 inch (38 mm) Insulation
  - 4. Field-Applied Jacket: Aluminum for outdoor, PVC for outdoor
  - 5. Vapor Retarder Required: Yes
- E. Service: Steam and condensate.
  - 1. Operating Temperature: 450 deg F (232 deg C) and lower.
  - 2. Insulation Material: Mineral Fiber
  - 3. Insulation Thickness: Apply the following insulation thicknesses:
    - a. Steel Pipe, Steam Up to 2 inches (50.8 mm): 2 1/2 inch (63 mm) Insulation
    - b. Steel Pipe, Steam 2 1/4 inches (57.2 mm) to 8 inches (203.2 mm): 3 1/2 inch (89 mm) Insulation
    - c. Steel Pipe, Condensate Up to 2 inches (50.8 mm): 1 1/2 inch (38 mm) Insulation
    - d. Steel Pipe, Condensate 2 1/4 inches (57.2 mm) to 8 inches (203.2 mm): 2 inches (50.8 mm) Insulation
- F. Field-Applied Jacket: Aluminum for outdoor, PVC for indoor
- G. Vapor Retarder Required: Yes

**END OF SECTION**

**SECTION 23 08 00**  
**COMMISSIONING OF HVAC SYSTEMS**

**PART 1 GENERAL**

**1.01 DESCRIPTION**

- A. The requirements of this Section apply to all sections of Division 23.

**1.02 RELATED WORK**

- A. Section 01 00 00 GENERAL REQUIREMENTS.

**1.03 SUMMARY**

- A. This Section includes requirements for commissioning the Facility exterior closure, related subsystems and related equipment.

**1.04 COMMISSIONED SYSTEMS**

- A. Commissioning of a system or systems specified in Division 23 is part of the construction process. Documentation and testing of these systems, as well as training of the Operation and Maintenance personnel in accordance with the requirements Division 23, is required in cooperation with the building representative and the Commissioning Agent.

**1.05 SUBMITTALS**

- A. The commissioning process requires review of selected Submittals that pertain to the systems to be commissioned. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the building representative prior to forwarding to the Contractor.
- B. The commissioning process requires Submittal review simultaneously with engineering review.

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION**

**3.01 CONSTRUCTION INSPECTIONS**

- A. Commissioning of HVAC systems will require inspection of individual elements of the HVAC systems construction throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with the Commissioning plan to schedule HVAC systems inspections as required to support the Commissioning Process.

**3.02 PRE-FUNCTIONAL CHECKLISTS**

- A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the Building Representative and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader



sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission.

### **3.03 CONTRACTORS TESTS**

- A. Contractor tests as required by other sections of Division 23 shall be scheduled and documented. All testing shall be incorporated into the project schedule. Contractor shall provide no less than 7 calendar days' notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

### **3.04 SYSTEMS FUNCTIONAL PERFORMANCE TESTING**

- A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed.

**END OF SECTION**

**SECTION 23 09 00  
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Related Documents:
  - 1. Drawings and general provisions of the Subcontract apply to this Section.
  - 2. Review these documents for coordination with additional requirements and information that apply to work under this Section.
- B. Section Includes:
  - 1. Complete system of automatic controls
  - 2. Pneumatic control system
  - 3. Electric control system
  - 4. Electronic control system
  - 5. Control devices, components, wiring, and material

**1.02 REFERENCES**

- A. GENERAL:
  - 1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
  - 2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.

**1.03 SUBMITTALS**

- A. Provide damper shop drawings that show data such as arrangement, velocities, and static pressure drops for each system.
- B. Provide complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences, and description and engineering data on each control system component. Include sizing as requested.
- C. At completion of work, submit report of check-out of automatic control system.
- D. Submit manufacturer's installation instructions.

**PART 2 PRODUCTS**

**2.01 SYSTEM REQUIREMENTS**

- A. Provide control systems consisting of thermostats, control valves, dampers, operators, indicating devices, interface equipment, and other apparatus required to operate mechanical system and to perform functions specified.
- B. Provide materials and field work necessary to connect control components factory-supplied as part of equipment controlled, unless specified otherwise. Generally, self-contained valves, filter gages, liquid-level controllers, and similar instruments are not to be installed under this section.
- C. Unless specified otherwise, provide fully proportional components.

**2.02 AIR COMPRESSOR AND RECEIVER**

- A. Sizing of compressor and storage tank shall limit compressor starts to 10 maximum per hour and 50 percent running time.
- B. Provide electrical alternation set to operate each compressor with provision for second

compressor to start on demand. Cycle compressors through pressure switch. If one compressor fails, the other automatically maintains air pressure.

- C. Provide refrigerated, noncycling air dryer, complete with automatic drain trap assembly and capacity to lower dew point to 5 deg F at 20 psi (-15 deg C at 1035 kPa). Mount unit in discharge air line from tank.

### **2.03 AIR PIPING**

- A. Piping: Hard or soft-drawn copper or polyethylene plastic tubing.
- B. Use copper lines in mechanical rooms where subject to damage or temperatures in excess of 200 deg F (93 deg C), where adjacent to heating pipes passing through common sleeve, and where not readily accessible. In mechanical room, use bundled plastic tubing with suitable junction boxes or single plastic tubing with tray.
- C. Leave two spares and two communication lines in bundled plastic tubing.
- D. Use exposed piping only in storage rooms. Install exposed piping in neat manner and support properly.
- E. Install pressure gages on branch lines, at each controller, and at each actuator and relay.
- F. Provide air lines, check valves, and hand valves to expansion tanks.

### **2.04 THERMOSTATS**

- A. Provide room thermostats with Fahrenheit ( deg F) scale, single temperature, gradual-acting, adjustable sensitivity. Provide covers with concealed set-point adjustment, set-point indication and with thermometer. Provide guards for thermostats in unsupervised or public areas. Differential shall not exceed 2.7 deg F (-16.2 deg C), with at least 11.7 deg F (-11.2 deg C) set-point adjustment.
- B. Provide manual-reset type freeze protection thermostats with 20 foot (6 m) element located to ensure maximum protection. Provide multiple thermostats for large duct cross-sectional areas.
- C. For remote-bulb elements, use either averaging type or suitable length for air or rigid-bulb type for liquids. Use stainless steel flanges to support elements in ducts. In liquids, use separable wells.

### **2.05 HUMIDISTATS**

- A. For humidity controllers, use direct- or reverse-acting type with differential not exceeding 5 percent relative humidity, and at least 60 percent set-point adjustment.

### **2.06 CONTROL VALVES**

- A. Provide valves in accordance with general valve specification. Provide position indicators on valves and pilot positioners on sequenced valves.
- B. Select valves to fail-safe in normally open or closed position as dictated by freeze, humidity, fire, or temperature protection.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Check and verify location of thermostats and other exposed control sensors with plans and room details before installation. Locate thermostats 60 inches (0.9 m) above floor.
- B. Interlock alarms with starter switching to bypass alarm when equipment is manually disconnected.

**END OF SECTION**

**SECTION 23 11 23  
FACILITY NATURAL-GAS PIPING**

**PART 1 GENERAL**

**1.01 DESCRIPTION**

- A. Fuel gas systems, including piping, equipment and all necessary accessories as designated in this section. Fuel gas piping for central boiler plants is not included.

**1.02 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
- B16.3-2011.....Malleable Iron Threaded Fittings: Classes 150 and 300
- B16.9-2012.....Factory Made Wrought Buttwelding Fittings
- B16.11-2011.....Forged Fittings, Socket-Welding and Threaded
- B16.15-2013.....Cast Copper Alloy Threaded Fittings: Classes 125 and 250
- B16.40-2013.....Manually Operated Thermoplastic Gas Shutoffs and Valves in Distribution Systems
- B31.8-2016.....Gas Transmission and Distribution Piping Systems
- C. American Society for Testing and Materials (ASTM):
- A47/A47M-1999 (R2014) .....Standard Specification for Ferritic Malleable Iron Castings
- A53/A53M-2012 .....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
- A536-1984 (R2014).....Standard Specification for Ductile Iron Castings
- A733-2015.....Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless-Steel Pipe Nipples
- B43-2015.....Standard Specification for Seamless Red Brass Pipe, Standard Sizes
- B687-1999(2011) .....Standard Specification for Brass, Copper, and Chromium-Plated Pipe Nipples
- D2513-2014e1 .....Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings
- D2683-2014 .....Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
- D3261-2016 .....Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
- D. American Water Works Association (AWWA):
- C203-2015 .....Coal-Tar Protective Coatings and Linings for Steel Water Pipes
- E. International Code Council (ICC):
- IFGC-2015 .....International Fuel Gas Code
- IPC-2015 .....International Plumbing Code
- F. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):
- SP-72-2010a .....Ball Valves with Flanged or Butt-Welding for General Service
- SP-110-2010 .....Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
- G. NACE International (NACE):
- SP0274-2011 .....High-Voltage Electrical Inspection of Pipeline Coatings

SP0490-2007 ..... Holiday Detection of Fusion-Bonded Epoxy External Pipeline  
Coating of 250 to 760  $\mu\text{m}$  (10 to 30 mil)

- H. National Fire Protection Association (NFPA):  
54-2015 National Fuel Gas Code

### 1.03 SUBMITTALS

- A. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 11 23, FACILITY NATURAL-GAS PIPING", with applicable paragraph identification.
- B. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
  - 1. Pipe & Fittings.
  - 2. Valves.
  - 3. Strainers.
  - 4. All items listed in Part 2 - Products.
- C. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane.
- D. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
  - 5. Include complete list indicating all components of the systems.
  - 6. Include complete diagrams of the internal wiring for each item of equipment.
- E. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

### 1.04 AS-BUILT DOCUMENTATION

- A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- B. Submit operation and maintenance data updated to include submittal review comments, Owner approved substitutions and construction revisions shall be inserted into a three-ring binder. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.
- C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement. Provide record drawings as follows:
  - 7. Red-lined, hand-marked drawings are to be provided, with one paper copy and a scanned PDF version of the hand-marked drawings provided on CD or DVD.
  - 8. As-built drawings are to be provided, with a copy of them on AutoCAD version. The CAD drawings shall use multiple line layers with a separate individual layer for each system.
  - 9. As-built drawings are to be provided, with a copy of them in three-dimensional Building Information Modeling (BIM) software version provided on CD or DVD.
- D. The as-built drawings shall indicate the location and type of all lockout/tagout points for all energy sources for all equipment and pumps to include breaker location and numbers, valve tag

numbers, etc. Coordinate lockout/tagout procedures and practices with local requirements.

- E. Certification documentation shall be provided to COR 21 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation/certification that all results of tests were within limits specified. Test results shall contain written sequence of test procedure with written test results annotated at each step along with the expected outcome or setpoint. The results shall include all readings, including but not limited to data on device (make, model and performance characteristics), normal pressures, switch ranges, trip points, amp readings, and calibration data to include equipment serial numbers or individual identifications, etc.

#### **1.05 SYSTEM PRESSURE**

- A. Natural gas systems are designed, materials and equipment are selected to prevent failure under gas pressure of 14.0 (w.c.).

### **PART 2 PRODUCTS**

#### **2.01 FUEL GAS SERVICE CONNECTIONS TO BUILDING**

- A. From inside face of exterior wall to approximately 1500 mm (5 feet) outside of building.
- B. Pipe: Black steel, ASTM A53/A53M, Schedule 40. Shop-applied pipe coating shall be one of the following types:
  - 1. Coal Tar Enamel Coating: Exterior of pipe and fittings shall be cleaned, primed with Type B primer and coated with hot-applied coal tar enamel with bonded layer of felt wrap in accordance with AWWA C203. Asbestos felt shall not be used; felt material shall be fibrous glass mat in accordance with AWWA C203.
- C. Holiday Inspections: Procedure for holiday inspection: Holiday Inspection shall be conducted on all coatings to determine the presence and number of discontinuities in those coatings using a Tinker & Rasor model AP/W Holiday Detector or equal. Holiday inspection shall be performed in a manner spelled out in the Tinker & Rasor operating instructions and at a voltage level recommended by the coating manufacturer or applicable NACE standard such as SP0274 or SP0490 in the case thermosetting epoxy coating. Holiday Detectors shall be calibrated and supplied with a certificate of calibration from the factory. A calibration of the Holiday Detector shall be performed once every 6 months to verify output voltages are true and correct.
- D. Steel Fittings:
  - 1. Butt weld fittings, wrought steel, ASME B16.9.
  - 2. Socket weld and threaded fittings forged steel, ASME B16.11.
  - 3. Grooved End: Ductile iron (ASTM A536, Grade 65-45-12), malleable iron (ASTM A47/A47M, Grade 32510), or steel (ASTM A53/A53M, Type F or Type E or S, Grade B).
- E. Steel Joints: Welded, ASME B31.8.

#### **2.02 EMERGENCY GAS SAFETY SHUT-OFF VALVE**

- A. Permits remote shut-off of fuel gas flow to boiler plant.
- B. Type: Manually opened, electrically held open, automatic closing upon power interruption. Pneumatic operator is prohibited.
- C. Performance: Shall shut bubble tight within one second after power interruption. Refer to the drawings for pressure, flow, and valve size requirements.
- D. Service: Natural gas and LP gas.
- E. Construction: UL listed, FM approved, rated for 861 kPa (125 psig) ASME flanged ends for pipe sizes above 50 mm (2 inches), threaded ends for pipe sizes 50 mm (2 inches) and under. Cast

iron, cast steel or bronze body, open and shut indicator. Valves for LP gas service shall be rated at 1725 kPa (250 psig).

- F. Control Switch: Mounted in Control Room. Switch shall also cut the power to the fuel oil pump set. Refer to Section 23 09 11, INSTRUMENTATION AND CONTROL FOR BOILER PLANT. Provide auxiliary switch to provide signal to Computer Work Station.

### **2.03 FUEL GAS PIPING ABOVE GROUND**

- A. Pipe: Black steel, ASTM A53/A53M, Schedule 40.
- B. Nipples: Steel, ASTM A733, Schedule 40.
- C. Fittings:
  - 1. Sizes 50 mm (2 inch) under ASME B16.3 threaded malleable iron.
  - 2. Over 50 mm (2 inch) and up to 100 mm (4 inch) ASME B16.11 socket welded.
  - 3. Over 100 mm (4 inch) ASME B16.9 butt welded.
- D. Joints: Provide welded or threaded joints.
- E. Threaded Metallic Joints: Threaded joints in metallic pipe shall have tapered threads evenly cut. Metal screwed pipe joints shall be made leak-tight by applying Rector Seal No. 5 pipe thread sealant to all threaded joints. Care must be taken to prevent the pipe dope compound from getting inside the internal pipeline. Teflon tape type sealant is prohibited.

### **2.04 EXPOSED FUEL GAS PIPING**

- A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed fuel gas piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Owner or specified in other sections.
  - 1. Pipe: ASTM B43, standard weight.
  - 2. Fittings: ASME B16.15 cast bronze threaded fittings with chrome finish, (125 and 250).
  - 3. Nipples: ASTM B687, Chromium-plated.
  - 4. Unions: 50 mm (2 inches) and smaller MSS SP-72, MSS SP-110, brass or bronze threaded with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.
  - 5. Valves: MSS SP-72, MSS SP-110, brass or bronze with chrome finish.
- B. Unfinished Rooms, Mechanical Rooms and Kitchens: Chrome-plated brass piping is not required. Paint piping systems as specified in Section 09 91 00, PAINTING.

### **2.05 VALVES**

- A. Ball Valve: Bronze body, rated for 1034 kPa at 185 degrees C (150 psig at 365 degrees F), 1723 kPa at 121 degrees C (250 psig at 250 degrees F), reinforced TFE seat, stem seal and thrust washer; end entry, threaded ends, UL-listed for natural or LP gas shut off service when used on those services.
- B. Gas Vent Cocks: Type 701: Bronze body, tee handle, rated for 207 kPa at 38 degrees C (30 psig at 100 degrees F), ground plug, rated for tight shut-off on fuel gas service.

### **2.06 WATERPROOFING**

- A. Provide at points where pipes pass through membrane waterproofed floors or walls in contact with earth.
- B. Floors: Provide cast iron stack sleeve with flashing device and an underdeck clamp. After stack is passed through sleeve, provide a waterproofed caulked joint at top hub.
- C. Walls: See detail shown on drawings.

**2.07 STRAINERS**

- A. Provide on high pressure side of pressure reducing valves, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings. Strainer element shall be removable without disconnection of piping.
- B. Gas Lines: "Y" type with removable mesh lined brass strainer sleeve.
- C. Body: Smaller than 75 mm (3 inches), brass or bronze; 75 mm (3 inches) and larger, cast iron or semi-steel.

**2.08 DIELECTRIC FITTINGS**

- A. Provide dielectric couplings or unions between ferrous and non-ferrous pipe.

**2.09 GAS EQUIPMENT CONNECTORS**

- A. Flexible connectors with Teflon core, interlocked galvanized steel protective casing, AGA certified design.

**2.10 FUEL GAS PIPING BELOW GROUND**

- A. Thermoplastic (Polyethylene - PE): PE pipe and heat fusion fittings shall conform to ASTM D2513, SDR 11 and manufactured for 861 kPa (125 psig) working pressure. Pipe and fittings shall have heat fusion joints PE pipe and fitting materials for heat fusion shall be compatible to ensure uniform melting and a proper bond.
- B. Fittings:
  - 1. Socket Fusion Fittings: ASTM D2683.
  - 2. Butt Fusion Fittings: ASTM D3261, molded and matching pipe dimensions.
- C. Risers: Manufacturer's standard anodeless type riser, transition from plastic to steel pipe with fusion bonded epoxy coating. Inlet connection socket or butt weld or swaged gas-tight construction with O-ring seals, metal insert, and protective sleeve. Outlet or above ground connection end shall be threaded or flanged. Riser shall comply with ASTM A53/A53M, Type F and E, Grade A, Schedule 40.
- D. Polyethylene ball valves, ASME B16.40 shall be manufactured and rated for underground gas service. Operating pressure to 861 kPa (125 psig) (SDR 9.3). Valve shall be maintenance and corrosion free. Polyethylene valves shall be full port opening type. Valves shall be wrench operated. Wrench operated valves shall have a 50 mm (2 inch) square adaptor securely fastened to the valve stem. Polyethylene valves shall be installed by butt fusion method.

**2.11 VALVE BOXES**

- A. Provide each valve on buried piping with a plastic or cast iron valve box of a size suitable for the valve. Valve box shall have a round cover with the word "Gas" cast on it. A metal tag or label shall be installed on top or inside of each valve box lid. The tag shall designate the appropriate location number, valve size, and other pertinent information. Each cast iron box shall be given a heavy coat of bituminous paint. Provide adjustable box extensions of length required for depth of buried valve.

**PART 3 EXECUTION****3.01 INSTALLATION**

- A. General: Comply with the ICC IFGC, ICC IPC and the following:
  - 1. Install branch piping for fuel gas and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Owner or specified in other sections.



2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, shall be reamed to full size after cutting.
3. All pipe runs shall be laid out to avoid interference with other work.
4. Install valves with stem in horizontal position whenever possible. All valves shall be easily accessible.
5. Install union and shut-off valve on pressure piping at connections to equipment.
6. Pipe Hangers, Supports and Accessories:
  - a. All piping shall be supported per the ICC IFGC.
  - b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with red lead or zinc Chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
  - c. Floor, Wall and Ceiling Plates, Supports, Hangers:
    - 1) Solid or split unplated cast iron, chrome plated in finished areas.
    - 2) All plates shall be provided with set screws.
    - 3) Pipe Hangers: Height adjustable clevis type.
    - 4) Adjustable Floor Rests and Base Flanges: Steel.
    - 5) Concrete Inserts: "Universal" or continuous slotted type.
    - 6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
    - 7) Riser Clamps: Malleable iron or steel.
    - 8) Rollers: Cast iron.
    - 9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
    - 10) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories.
7. Install cast chrome plated escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
8. Penetrations:
  - a. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Completely fill and seal clearances between piping and openings with the fire stopping materials.
  - b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.
- B. Fuel gas piping shall conform to the following:
  1. Entire fuel gas piping installation shall be in accordance with requirements of NFPA 54.
  2. Provide fuel gas piping with plugged drip pockets at low points.
- C. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Owner.

### **3.02 CLEANING OF SYSTEM AFTER INSTALLATION**

- A. Clean all piping systems to remove all dirt, coatings and debris.

### **3.03 TESTS**

- A. General: Test system either in its entirety or in sections after system is installed or cleaned.
- B. Test shall be made in accordance with Section 406 of the International Fuel Gas Code. The system shall be tested at a minimum of 1.5 times maximum working pressure, but not less than 3 psig (21 kPa) gauge.

- C. System Purging: After completing pressure tests, and before testing a gas-contaminated line, purge line with nitrogen at junction with main line to remove all air and gas. Clear completed line by attaching a test pilot fixture at capped stub-in line at building location and let gas flow until test pilot ignites. Procedures shall conform to NFPA 54 and ASME B31.8.

#### **3.04 STARTUP AND TESTING**

- A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Owner.

#### **3.05 COMMISSIONING**

- A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.
- B. Components provided under this section of the specification will be tested as part of a larger system.

**END OF SECTION**

**SECTION 23 23 00  
REFRIGERANT PIPING**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Related Documents:
  - 1. Drawings and general provisions of the Subcontract apply to this Section.
  - 2. Review these documents for coordination with additional requirements and information that apply to work under this Section.
- B. Section Includes:
  - 1. Liquid indicators.
  - 2. Strainers.
  - 3. Refrigerant driers.
  - 4. Filter-driers.
  - 5. Solenoid valves.
  - 6. Expansion valves.
  - 7. Refrigerant-charging valves.

**1.02 REFERENCES**

- A. General:
  - 1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
  - 2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.

**1.03 SUBMITTALS**

- A. Submit manufacturer's installation instructions.
- B. Shop drawing of the refrigerant one line, total linear footage, and amount of refrigerant in the lines.

**PART 2 PRODUCTS**

**2.01 LIQUID INDICATORS**

- A. Double-port type with copper or brass body and flared or solder ends.
- B. Provide removable seal caps on each port for inspection of refrigerant condition.
- C. Provide full-size liquid indicators in main liquid line leaving condenser. If receiver is used, install in liquid line leaving receiver.

**2.02 STRAINERS**

- A. Angle type with brass shell and replaceable cartridge.
- B. Suitable for refrigerant and piping material utilized in the system.
- C. Provide full-size strainer ahead of each automatic valve. When multiple expansion valves with integral strainers are used, install single main-liquid-line strainer.
- D. On steel piping systems, provide strainer in suction line to remove scale and rust.
- E. Provide shut-off valve on each side of strainer to facilitate maintenance.

**2.03 REFRIGERANT DRIERS**

- A. In-line or angle type with copper or brass shell.
- B. Employ replaceable desiccant drier material.
- C. Provide full-flow, permanent refrigerant drier in low-temperature systems and systems using hermetic compressors.
- D. Provide three-valve bypass assembly.

#### **2.04 FILTER-DRIERS**

- A. Angle type, with brass shell, using combined straining and drying material.
- B. Employ replaceable desiccant material.
- C. Acceptable in-lieu of separate strainers and driers.
- D. Provide three-valve bypass assembly.

#### **2.05 SOLENOID VALVES**

- A. Copper or brass body with flared or threaded ends.
- B. Use replaceable coil assembly.
- C. Provide a manually-operated stem to permit operation in case of coil failure.
- D. Provide solenoid valves in liquid line of systems operating with single pump-out or pump-down compressor control, in liquid line of single or multiple evaporator systems, and in oil-bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when system shuts down.

#### **2.06 EXPANSION VALVES**

- A. Angle type or straight-through design suitable for the refrigerant used in the system.
- B. Brass body, internal or external equalizer, and adjustable superheat setting, complete with capillary-tube and remote sensing bulb.
- C. Size expansion valves to avoid being undersized at full load and excessively oversized at partial load.
- D. Evaluate refrigerant pressure drop through system to determine the available pressure drop across each valve.
- E. Select valves for maximum load at design operating pressure and at least 43°F of superheat.

#### **2.07 CHARGING VALVES**

- A. General-purpose type with brass body, flared or solder ends, and removable valve core.
- B. Provide valve inlet with quick-coupling connection for ease of charging.
- C. Provide refrigerant charging connections in liquid line between receiver shut-off valve and expansion valve.

#### **2.08 VALVES**

- A. Diaphragm Packless Valves:
  - 1. UL listed, globe or angle pattern, forged brass body and bonnet solder or flared ends.
  - 2. Phosphor bronze and stainless steel diaphragms, rising stem and hand wheel.
  - 3. Stainless steel spring, nylon seats, disc with positive back seating.
  - 4. Maximum working pressure: 500 psig.
  - 5. Maximum working temperature: 275 degrees F.
- B. Packed Angle Valves:
  - 1. Forged brass or nickel-plated forged steel, solder or flared ends.
  - 2. Forged brass seal caps with copper gasket, rising stem and seat, molded stem packing.
  - 3. Maximum working pressure: 500 psig.
  - 4. Maximum working temperature: 275 degrees F.

- C. Ball Valves:
  - 1. Two-piece bolted forged brass body with Teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals, soldered or threaded ends.
  - 2. Maximum working pressure: 500 psig.
  - 3. Maximum working pressure: 500 psig.
- D. Service Valves:
  - 1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends.
  - 2. Maximum working pressure: 500 psig.
- E. Refrigerant Check Valves:
  - 1. Globe Type:
    - a. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, Teflon seat disc.
    - b. Maximum working pressure: 500 psig.
    - c. Maximum working temperature: 300 degrees F.
  - 2. Straight Through Type:
    - a. Spring, neoprene seat.
    - b. Maximum working pressure: 500 psig.
    - c. Maximum working temperature: 250 degrees F.

## **2.09 FLEXIBLE CONNECTORS**

- A. Close-pitch corrugated bronze hose with single layer of exterior braiding.
- B. At least 9-inches long with bronze fittings.
- C. Use only at or near compressors where it is not physically possible to absorb vibration within piping configuration.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install all items in accordance with manufacturer's printed instructions

### **3.02 REFRIGERANT DRIERS**

- A. Mount drier vertically in liquid line, adjacent to receiver, with bypass assembly to permit isolation of drier for servicing.

### **3.03 FILTER-DRIERS**

- A. Install with bypass assembly to permit isolation for servicing.

### **3.04 EXPANSION VALVES**

- A. Locate expansion-valve sensing bulb immediately after evaporator outlet on suction line.

**END OF SECTION**

**SECTION 23 31 13  
METAL VENTILATION DUCTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Classified, fire-rated general ventilation duct with or without internal subducts.
- B. Classified, fire-rated kitchen ventilation grease ducts.

**1.02 RELATED WORK**

- A. Section 23 05 00 - Common Work Results for HVAC.

**1.03 REFERENCES**

- A. American National Standards institute/Underwriter's laboratory (ANSI/UL) 1479 - Standard for Fire Tests of Through-Penetration Firestops.
- B. National Fire Protection Association, NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- C. International Standards Organization (ISO)-6944 - Fire Resistance Tests -- Ventilation Ducts.
- D. Underwriter's laboratory (UL) 1978 - Grease Ducts.
- E. Underwriter's laboratory (UL) 2221 - Fire Resistive Grease Duct Enclosure Assemblies.
- F. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 90 - Energy Standard for Buildings Except Low-Rise Residential Buildings

**1.04 SUBMITTALS**

- A. 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.
- B. Shop Drawings: The manufacturer shall provide "to scale" drawings depicting the actual layout. The exhaust system shall be installed as designed by the manufacturer and in accordance with the terms of the manufacturer's warranty and in conjunction with sound engineering practices.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Minimum 5-year experience manufacturing similar products.
- B. Manufacturer Representation: The factory built modular exhaust system shall be furnished by a vendor organization that assures design, installation and services coordination. As well as, providing "in-warranty" and "post-warranty" unified responsibility for owner, consulting engineer and contractor.
- C. Installer Qualifications: Minimum 1-year experience installing similar products.
- D. Product Requirements: The exhaust system shall be installed as designed by the manufacturer and in accordance with the terms of the manufacturer's warranty and in conjunction with sound engineering practices.
- E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
  - 1. Finish areas designated by Owner.
  - 2. Do not proceed with remaining work until workmanship is approved by Owner.
  - 3. Refinish mock-up area as required to produce acceptable work.

**1.06 PRE-INSTALLATION MEETINGS**

- A. Convene minimum two weeks prior to starting work of this section.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Handling: Handle materials to avoid damage.

#### **1.08 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 recommended limits.

#### **1.09 SEQUENCING**

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

#### **1.10 WARRANTY**

- A. The exhaust system shall have a limited lifetime warranty against functional failure due to defects in material and manufacturer's workmanship from the date of installation.
- B. Listed Ventilation Duct shall be warranted by the duct system manufacturer against defects in material and workmanship for a limited lifetime from the original date of installation. Any portion of the ventilation duct repaired or replaced under warranty shall be warranted for the remainder of the original warranty terms and conditions.

### **PART 2 PRODUCTS**

#### **2.01 SHEET METAL MATERIALS**

- A. All duct work gauges, requirements, and material type, are specified hereinafter or in the engineers drawings.
- B. Galvanized Sheet Steel:
  - 1. Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Carbon-Steel Sheets:
  - 1. ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, matte finish for exposed ducts.
- D. Stainless Steel:
  - 1. ASTM A 480/A 480M, Type 304 & 316.
- E. Aluminum Sheets:
  - 1. ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- F. Tie Rods:
  - 1. Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.
- G. Insulated Flexible Ducts:
  - 1. Flexible ducts wrapped with flexible glass fiber insulation, enclosed by seamless aluminum pigmented plastic vapor barrier jacket.

#### **2.02 SINGLE WALL PLENUMS**

- A. Machine formed panels, 18 gauge steel with 3" standing seams 16" on center.

- B. General Duty: Galvanized steel.
- C. Machine formed panels, 24 gauge steel with 3" standing seams 16" on center as specified on the drawings.

### **2.03 DUCT SEALING AND ACCEPTABLE MATERIALS**

- A. All accessible portions of the duct which require sealing shall be exposed and sealed with approved materials. The following are examples of sealing opportunities: Plenum; Air-handler cabinet to plenum; Plenum-to-takeoff connections; Finger/dovetail joints; Branch T's, Y's and L's; Supply and Return Boots; Duct-to-duct connections; Gores on Adjustable Elbows; and End Caps.
- B. Loose tape shall be removed from rigid metal ducts prior to sealing. Secured tape that remains must be completely covered with mastic which shall extend at least 1/2 inch beyond the tape edge on either side and be at least 1/8 inch thick.
- C. Non-flex duct joints, connections and seams shall be sealed with UL-181 listed mastic.
  - 1. The application of mastic shall be done according to manufacturer specifications.
  - 2. Take offs and crimped fitted joints shall be mechanically secured with screws and sealed with mastic. Non-leaking seams such as S-drive and snappies are exempt from being sealed with mastic.
  - 3. On the air handler, only foil or mastic HVAC tape labeled as meeting UL-181 standards may be used.
  - 4. Cloth-backed duct tape shall not be used to seal, secure, or fasten ducts.
  - 5. Boots shall be mechanically fastened to the subfloor and properly sealed with UL-181 mastic or UL-181 sealant.
- D. Flexible duct connections shall have the interior and exterior liners secured and air-sealed with nylon straps (Panduit or equivalent) and tightened with a manufacturer-approved tensioning tool. Steel band clamps with worm drive tension adjusters are also acceptable.
- E. The return should be sealed if it is easily accessible and in unconditioned space.
- F. End caps must be made of either sheet metal or a UL-181 approved rigid product.
- G. All ducts will sealed to a minimum LEVEL A ASHRAE 90 6.4.4.2.1

### **2.04 GASKET MATERIAL**

- A. For non-fume exhaust duty and galvanized fume exhaust duct duty: Tremco 440, Ductmate 440, or equivalent, minimum 3/16" thick by 1/2" wide.
- B. For stainless steel and coated fume exhaust duct duty: Where removable sections are required, use hypalon gaskets with silicone mastic.

### **2.05 DUCT SUPPORT**

- A. All accessible portions of the duct system which require support shall be supported.
- B. To minimize the possibility of disconnection, flexible ducts shall be supported every 4 feet and within 3 feet of each connection to a rigid duct, with straps that are not less than 1 1/2 inches wide each and that do not restrict airflow.

### **2.06 DUCTWORK FASTENERS**

- A. General:
  - 1. Rivets, bolts, or sheet metal screws.
  - 2. Ductwork fasteners shall be same metal as duct being supported, unless otherwise noted.
- B. Self-Drilling Screws:
  - 1. Galvanized Steel Ductwork System: Sheet metal screws shall be hex washer head (HWH) TEKS® self-drilling type, formed from heat-treated carbon steel with zinc electroplated finish.
  - 2. Aluminum Ductwork System:



- a. Sheet metal screws shall be hex washer head (HWH) self-drilling type, formed from heat-treated type 410 stainless steel, complete with bonded metal and fiber washer for dielectric separation.
- 3. Stainless Steel Ductwork System:
  - a. Sheet metal screws shall be hex washer head (HWH) self-drilling type, formed from heat-treated type 410 stainless steel.

## **2.07 DUCT INSULATION**

- A. Duct Work in unconditioned spaces will be insulated.
  - 1. A minimum of R-8 will be used.
  - 2. Foil Faced FSK wrap insulation will be used.
- B. Duct insulation will be mechanically fastened.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. General: Comply with the ICC IFGC, ICC IPC and the following:
  - 1. Install branch piping for fuel gas and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Owner or specified in other sections.
  - 2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, shall be reamed to full size after cutting.
  - 3. All pipe runs shall be laid out to avoid interference with other work.
  - 4. Install valves with stem in horizontal position whenever possible. All valves shall be easily accessible.
  - 5. Install union and shut-off valve on pressure piping at connections to equipment.
  - 6. Round and Flat Oval Fittings:
    - a. Metal Gauge:
      - 1) Use 16 gauge (1.61 mm) unless otherwise specified on the engineers drawing.
    - b. Elbows:
      - 1) Elbows shall have a centerline radius of minimum 1.5 times the duct diameter. Elbows up to 15 degrees shall be 3 pieces, 30 degrees 4 pieces, and 5 pieces between 31 to 90 degrees. Elbows shall be fabricated from continuously butt-welded gore sections. Gore sections shall be welded and finish ground to eliminate internal and external projections.
    - c. Increases and Reducers:
      - 1) ASME short flow nozzle shape, continuously butt-welded.
    - d. Tees:
      - 1) Conical short flow nozzle shape continuously butt-welded.
    - e. Laterals:
      - 1) Conical ASME short flow nozzle shape at 30 degrees to 45 degrees, continuously butt-welded.
    - f. Round Tap Fittings:
      - 1) 45 degrees conical taps, continuously butt-welded.
    - g. Join fittings using companion-angle Vanstone flange connection. Seal connection with specified sealant or gasket when a removable connection is required.
  - 7. Rectangular or Square Ductwork
    - a. Longitudinal seams shall be continuously welded. Fabricate duct sections with one longitudinal seam and install with seam at top of duct. Cover seam with specified

- sealant.
- b. Metal Gauge:
  - 1) Use 16 gauge (1.61 mm) unless otherwise specified on the engineers drawing.
- c. Angles:
  - 1) Reinforcing and stiffening angles shall be required on four sides. Angles shall be galvanized steel.
- d. Cross break duct on four sides between transverse joints and angle stiffeners.
- e. Spot weld stiffeners to duct o.c. and at corners where they join.
- f. Rectangular or Square Fittings and Transitions:
  - 1) Longitudinal seams shall be continuously butt-welded. Fabricate fittings and transitions with one or two seams at top of duct. Fittings and transition shall be fabricated of 16 gauge (1.61 mm) sheet metal unless otherwise specified on engineer drawings.
- g. Seal joints with specified sealant or gasket when a removable connection is required.
- 8. Pipe Hangers, Supports and Accessories:
  - a. All piping shall be supported per the ICC IFGC.
  - b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with red lead or zinc Chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
  - c. Floor, Wall and Ceiling Plates, Supports, Hangers:
    - 1) Solid or split unplated cast iron, chrome plated in finished areas.
    - 2) All plates shall be provided with set screws.
    - 3) Pipe Hangers: Height adjustable clevis type.
    - 4) Adjustable Floor Rests and Base Flanges: Steel.
    - 5) Concrete Inserts: "Universal" or continuous slotted type.
    - 6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
    - 7) Riser Clamps: Malleable iron or steel.
    - 8) Rollers: Cast iron.
    - 9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
    - 10) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories.
- 9. Install cast chrome plated escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
- 10. Penetrations:
  - a. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases. Completely fill and seal clearances between piping and openings with the fire stopping materials.
  - b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight.
- B. Fuel gas piping shall conform to the following:
  - 1. Entire fuel gas piping installation shall be in accordance with requirements of NFPA 54.
  - 2. Provide fuel gas piping with plugged drip pockets at low points.
- C. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Owner.
- D. All supply ducting in unconditioned spaces shall be insulated with foiled faced FSK.

1. A minimum of R-8.
2. Mechanically fastened.
- E. Manual Balancing Dampers.
  1. Fabricate as specified. Leave 1/8" (3mm) maximum gap between damper blade and duct wall.
  2. Install dampers in sperate, flanged, bolted, removable duct separations.

### **3.02 CLEANING OF SYSTEM AFTER INSTALLATION**

- A. Clean all piping systems to remove all dirt, coatings and debris.

### **3.03 TESTS**

- A. General: Test system either in its entirety or in sections after system is installed or cleaned.
- B. Test shall be made in accordance with Section 406 of the International Fuel Gas Code. The system shall be tested at a minimum of 1.5 times maximum working pressure, but not less than 3 psig (21 kPa) gauge.
- C. System Purging: After completing pressure tests, and before testing a gas-contaminated line, purge line with nitrogen at junction with main line to remove all air and gas. Clear completed line by attaching a test pilot fixture at capped stub-in line at building location and let gas flow until test pilot ignites. Procedures shall conform to NFPA 54 and ASME B31.8.

### **3.04 STARTUP AND TESTING**

- A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Owner.

### **3.05 COMMISSIONING**

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- B. Components provided under this section of the specification will be tested as part of a larger system.

**END OF SECTION**

**SECTION 23 33 00  
DUCTWORK ACCESSORIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Manual volume dampers
- B. Fire dampers

**1.02 SUBMITTALS**

- A. Submit shop drawings and product data per applicable Division I Specifications.
- B. Shop drawings shall include material, sizes, quantities, and dimensions.

**1.03 QUALITY ASSURANCE**

- A. SMACNA HVAC Duct Construction Standards-Metal and Flexible.
- B. UL181 .
- C. NFPA 90A and 90B.
- D. ASHRAE Handbook, HVAC Systems and Equipment.
- E. Dampers shall meet the requirements of Ashrae standard 90.1.

**PART 2 PRODUCTS**

**2.01 MANUAL VOLUME DAMPERS**

- A. Manufacturers
  - 1. Ruskin
  - 2. United Sheet Metal
  - 3. Fabco
- B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible, and as indicated.
- C. Splitter Dampers:
  - 1. Material: Same gauge as duct to 24 inches size in either direction, and two gauges heavier for sizes over 24 inches.
  - 2. Blade: Fabricate of double thickness sheet metal to streamline shape, secured with continuous hinge or rod.
  - 3. Operator: Minimum 1/4" diameter rod in self aligning, universal joint action, flanged bushing with set screw.
- D. Single Blade Dampers: Fabricate for duct sizes up to with smallest dimension less than 12 inches.
- E. Multi-Blade Damper: Factory made of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble and edge crimped blades in prime coated or galvanized channel frame with suitable hardware; Use multi-blade dampers with smallest dimension 12" or larger.
- F. End Bearings: Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.
- G. Quadrants:
  - 1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
  - 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
  - 3. Where rod lengths exceed 30 inches provide regulator at both ends.

**2.02 FIRE DAMPERS**

- A. Manufacturers
  - 1. Air Balance

2. Ruskin
3. Safe – Aire
4. Prefco
- B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated. Air Balance type 119 in medium pressure ductwork and type ML in low-pressure ductwork.
- C. Fire Dampers where either dimension is less than 24" in width or 12" in height, the unit size shall be based on inside frame dimension.
- D. Fire Dampers in medium pressure ductwork shall have 100% free area when open with frame and blades outside the duct area.
- E. Horizontal Dampers: Galvanized steel, 22 gauge frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.
- F. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for closure under air flow conditions.
- G. Multiple Blade Dampers: 16 gauge galvanized steel frame and blades, oil impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8" x 1/2" plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.
- H. Fusible Links: UL 33.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Install manufactured products in accordance with manufacturer's instructions.
- B. Provide splitter dampers, manual volume control dampers and/or extractors at points on supply, return, and exhaust systems as required for air balancing.
- C. Provide fire dampers at locations indicated, where duct, outlets and inlets pass through fire rated components and where required by authorities having jurisdiction. Install per UL and manufacturers requirements with required perimeter mounting angles, sleeves, breakaway duct connections and sealing. Provide gentle transitions from adjacent ducts to dampers.
- D. Demonstrate resetting of fire dampers to authorities having jurisdiction and Owner's representative.
- E. Provide motorized shut-off dampers on exhaust fans or in exhaust ducts and in relief assemblies nearest to outside and where indicated.
- F. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.
- G. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, any motorized dampers, at splitter dampers, at relief dampers and at fire dampers. Provide minimum 12 x 12 inch size for hand access, 24 x 24 inch size for shoulder access. Size doors generously as the Architect will determine if doors are reasonable for intended access.
- H. Provide duct test holes where required for testing and balancing purposes.
- I. Transition ducts gently to allow installation of duct accessories if required.
- J. Provide architectural access doors and install in architectural entities whenever access is required for work of this section. Doors and installation to meet the approval of the Architect.
- K. Install negative pressure relief doors immediately downstream and a positive pressure relief access door upstream of all fire dampers (or other dampers subject to sudden closure). See Specification Section 23 33 00 for access door work.

- L. Installation of duct accessories in exposed ducts to be done for best aesthetics. Prime accessories, shafts, operators, linkages, etc.
- M. Provide openings in ductwork to accommodate rods, shafts, etc. and seal and insulate (if required).
- N. Locate accessories for proper operation and service.
- O. Provide turning vanes in all mitered ductwork 90 degree elbows.
- P. Provide duct mounted access doors and panels to all fire dampers, control damper, plenum housings.

**END OF SECTION**

**SECTION 23 37 00  
AIR INLETS AND OUTLETS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Related Documents:
  - 1. Drawings and general provisions of the Subcontract apply to this Section.
  - 2. Review these documents for coordination with additional requirements and information that apply to work under this Section.
- B. Section Includes:
  - 1. Diffusers.
  - 2. Grilles and registers.
  - 3. Outside louvers.
  - 4. Door grilles.
  - 5. Diffuser boots.
  - 6. Roof hoods.
  - 7. Goosenecks.

**1.02 REFERENCES**

- A. General:
  - 1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
  - 2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.
  - 3. Refer to Division 23 Section "Common Results for HVAC" for codes and standards, and other general requirements.
- B. Air Diffuser Council (ADC):
  - 1. ADC Applicable Standards.
- C. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
  - 1. ASHRAE 52 Method of Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter
- D. National Fire Protection Association (NFPA):
  - 1. NFPA 90A Installation of Air Conditioning and Ventilating Systems
  - 2. NFPA 90B Installation of Warm Air Heating and Air Conditioning Systems

**1.03 SUBMITTALS**

- A. Submit under provisions of Division 23 Section "Common Results for HVAC."
- B. Shop Drawings:
  - 1. Check location of outlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
  - 2. Review requirements of outlets as to size, finish, and type of mounting prior to submitting shop drawings and schedules of outlets.
- C. Product Data: Cover each item, together with schedule of outlets, and manufacturer's installation instructions.

**1.04 QUALITY ASSURANCE**

- A. Make airflow tests and sound-level measurements in accordance with applicable ADC equipment

test codes and ASHRAE standards.

- B. Manufacturer shall certify cataloged performance and ensure correct application of air-outlet types.

## **PART 2 PRODUCTS**

### **2.01 APPLICATION**

- A. Rate units in accordance with ADC standards.
- B. Base air outlet application on space noise level 35 dBa.
- C. Provide supply outlets with sponge-rubber seal around edge.
- D. Provide baffles to direct air away from walls, columns, or other obstructions within radius of diffuser operation.
- E. Provide plaster frame for diffusers located in plaster surfaces.
- F. Provide anti-smudge frames or plaques on diffusers located in rough textured surfaces such as an acoustical plaster.

### **2.02 SUPPLY GRILLES**

- A. For sidewall supply grilles, provide streamlined and individually adjustable blades, depth of which exceeds 3/4-inch (19-mm) maximum spacing. Provide spring tension or other device to set blades.
- B. Provide 1-1/4 inch (32-mm) margin frame with countersunk screw holes.
- C. Fabricate of steel with 20-gauge (0.9-mm) or heavier frames and 22-gauge (0.8-mm) or heavier blades, steel and aluminum with 20-gauge (0.9-mm) or heavier frame, or aluminum extrusions.
- D. Provide grilles with integral, gang-operated opposed-blade dampers with removable key operator, operable from face.

### **2.03 LOUVERED SUPPLY GRILLES**

- A. For ceiling supply grilles, provide streamlined and individually adjustable curved blades to discharge air along face of grille. Units shall have two-way deflection.
- B. Provide 1-1/4 inch (32-mm) margin frame with countersunk screw holes.
- C. Fabricate of aluminum extrusions.
- D. Provide grilles with integral, gang-operated opposed-blade dampers with removable key operator, operable from face.

### **2.04 LINEAR SUPPLY GRILLES**

- A. Linear supply grilles shall have streamlined blades with 15-degree deflection, 1/8 inch (3 mm) on 1/4-inch (6-mm) centers.
- B. Fabricate of aluminum extrusions.
- C. Provide 1-1/4 inch (32-mm) margin frame with countersunk screw holes.
- D. Provide grilles with integral hinged single-blade damper with removable key operator, operable from face.
- E. Provide mounting frame suitable for casting in concrete floor.

### **2.05 RETURN AND EXHAUST GRILLES**

- A. For sidewall and ceiling exhaust grilles, provide streamlined blades, depth of which exceeds 3/4-inch (19-mm) spacing. Provide spring tension or other device to set blades.
- B. Provide 1-1/4 inch (32-mm) margin frame with countersunk screw holes.
- C. Fabricate of steel with 20-gauge (0.9-mm) or heavier frames and 22-gauge (0.8-mm) or heavier blades, steel and aluminum with 20-gauge (0.9-mm) or heavier frame, or aluminum extrusions.



- D. Provide exhaust grilles, where not individually connected to exhaust fans, with integral, gang-operated opposed-blade dampers with removable key operator, operable from face.

## **2.06 GRID CORE RETURN AND EXHAUST GRILLES**

- A. Fabricate fixed grilles of 1/2-inch (13-mm) louvers.
- B. Provide 1-1/4 inch (32-mm) margin frame with countersunk screw holes or lay-in frame for suspended grid ceilings.
- C. Fabricate of aluminum.
- D. Provide exhaust grilles, where not individually connected to exhaust fans, with integral, gang-operated opposed-blade dampers with removable key operator, operable from face.

## **2.07 LINEAR RETURN OR EXHAUST GRILLES**

- A. Linear supply grilles shall have streamlined blades with 15-degree deflection, 1/8 inch (3 mm) on 1/4-inch (6-mm) centers.
- B. Provide 1-1/4 inch (32-mm) margin frame [extra heavy for floor mounting, with countersunk screw holes.
- C. Fabricate of steel with 20-gauge (0.9-mm) or heavier frames and 22-gauge (0.8-mm) or heavier blades, steel and aluminum with 20-gauge (0.9-mm) or heavier frame, or aluminum extrusions.
- D. Provide exhaust grilles, where not individually connected to exhaust fans, with integral, gang-operated opposed-blade dampers with removable key operator, operable from face.
- E. Provide mounting frame for casting in concrete floor.

## **2.08 ROUND SUPPLY DIFFUSER**

- A. Provide round, adjustable pattern, stamped or spun, multi-core type diffuser to discharge air in 360-degree pattern, with sectorizing baffles.
- B. Project diffuser collar not more than 1 inch (25 mm) above ceiling face and connect to duct with duct ring.
- C. Fabricate of steel with baked-enamel finish.
- D. Provide radial opposed-blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

## **2.09 GOOSENECKS**

- A. Fabricate goosenecks of 18-gauge (1.2-mm) or heavier galvanized steel.
- B. Mount on at least 12-inch (300-mm) high curb base where size exceeds 9 inches (225 mm).

# **PART 3 EXECUTION**

## **3.01 INSTALLATION**

- A. Install all items in accordance with manufacturer's printed instructions.

**END OF SECTION**

**SECTION 23 81 29**  
**VARIABLE REFRIGERANT FLOW HVAC SYSTEM**

**PART 1 GENERAL**

**1.01 SYSTEM DESCRIPTION**

- A. The variable capacity, heat pump heat recovery air conditioning system shall be a Mitsubishi Electric CITY MULTI VRF (Variable Refrigerant Flow) zoning system.
- B. The R2-Series system shall consist of a PURY outdoor unit, BC (Branch Circuit) Controller, multiple indoor units, and M-NET DDC (Direct Digital Controls). Each indoor unit or group of indoor units shall be capable of operating in any mode independently of other indoor units or groups. System shall be capable of changing mode (cooling to heating, heating to cooling) with no interruption to system operation. To ensure owner comfort, each indoor unit or group of indoor units shall be independently controlled and capable of changing mode automatically when zone temperature strays 1.8 degrees F from set point for ten minutes. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of outdoor rated capacity.
- C. The Y-Series system shall consist of PUHY outdoor unit, multiple indoor units, and M-NET DDC (Direct Digital Controls). The sum of connected capacity of all indoor air handlers shall range from 50% to 130% of outdoor rated capacity.
- D. The PU\*Y-P\*\*KMU-U CITY MULTI system shall be capable of qualifying for the Buy American Act with a waiver under the non-availability exception based on the determination by the U.S. Customs and Border Protection that the key components, the ODUs, are a "product of the US" for the purposes of U.S. Government procurement. (Federal Register / Vol. 79, No. 220 / Friday, November 14, 2014 pages 68284-68246)

**1.02 QUALITY ASSURANCE**

- A. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.
- B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
- C. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).
- D. All units must meet or exceed the 2010 Federal minimum efficiency requirements and the ASHRAE 90.1 efficiency requirements for VRF systems. Efficiency shall be published in accordance with the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standard 1230.
- E. A full charge of R-410A for the condensing unit only shall be provided in the condensing unit.

**1.03 DELIVERY, STORAGE AND HANDLING**

- A. The control system shall consist of a low voltage communication network of unitary built-in controllers with on-board communications and a web-based operator interface. A web controller with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.
- B. System controls and control components shall be installed in accordance with the manufacturer's written installation instructions.
- C. Furnish energy conservation features such as optimal start, night setback, request-based logic, and demand level adjustment of overall system capacity as specified in the sequence.
- D. System shall provide direct and reverse-acting on and off algorithms based on an input condition or group conditions to cycle a binary output or multiple binary outputs.

- E. Provide capability for future system expansion to include monitoring and use of occupant card access, lighting control and general equipment control.
- F. System shall be capable of email generation for remote alarm annunciation.
- G. Control system start-up shall be a required service to be completed by the manufacturer or a duly authorized, competent representative that has been factory trained in Mitsubishi Electric controls system configuration and operation. The representative shall provide proof of certification for Mitsubishi Electric Controls Applications Training indicating successful completion of no more than two (2) years prior to system installation. This certification shall be included as part of the equipment and/or controls submittals. This service shall be equipment and system count dependent and shall be a minimum of one (1) eight (8) hour period to be completed during normal working hours.

**1.04 PEFY-NMH(S)U (ALTERNATE HIGH STATIC OPTION), CEILING-CONCEALED DUCTED INDOOR UNIT**

- A. General:
  - 1. The PEFY-NMH(S)U (Alternate High Static Option) unit shall be a ceiling concealed ducted indoor fan coil that mounts above the ceiling with a fixed rear return and a horizontal discharge supply, and shall have a modulating linear expansion device. The PEFY-NMH(S)U shall be used with the R2-Series outdoor unit and BC Controller, Y-Series outdoor unit, or S-Series outdoor unit. The PEFY-NMH(S)U shall support individual control using M-NET DDC controllers. PEFY-NMH(S)U models shall feature external static pressure settings up to 1.00 in. WG. Units shall have the ability to control supplemental heat via connector CN24 or CN4F and a 12 VDC output. The unit shall be suitable for use in plenums in accordance with UL1995 ed 4
- B. Indoor Unit:
  - 1. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.
- C. Unit Cabinet:
  - 1. The cabinet shall be ceiling-concealed, ducted.
  - 2. The cabinet panel shall have provisions for a field installed filtered outside air intake.
- D. Fan:
  - 1. The indoor unit fan shall be an assembly with one or two Sirocco fan(s) direct driven by a single motor.
  - 2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
  - 3. The indoor unit shall have a ducted air outlet system and ducted return air system.
- E. Filter:
  - 1. Return air shall be filtered by a field-supplied filter.
  - 2. Optional rear return filter box with long-life filter shall be available for all PEFY-NMH(S)U-E indoor units.
- F. Coil:
  - 1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
  - 2. The tubing shall have inner grooves for high efficiency heat exchange.
  - 3. All tube joints shall be brazed with phos-copper or silver alloy.
  - 4. The coils shall be pressure tested at the factory.
  - 5. A condensate pan and drain shall be provided under the coil.

6. The condensate shall be gravity drained from the fan coil.
7. Both refrigerant lines to the PEFY indoor units shall be insulated in accordance with the installation manual.
- G. Electrical:
  1. Heat pumps 1 and 2 shall be 208/230 volts, 3-phase, 60 hertz.
    - a. Heat pump 3 shall be 208/230 volts, 1-phase, 60 hertz.
  2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).
- H. Controls:
  1. This unit shall use controls provided by Mitsubishi Electric to perform functions necessary to operate the system. Please refer to Part 5 of this guide specification for details on controllers and other control options.
  2. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
  3. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.
  4. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
  5. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

## **PART 2 WARRANTY**

### **2.01 THE CITY MULTI UNITS SHALL BE COVERED BY THE MANUFACTURER'S LIMITED WARRANTY FOR A PERIOD OF ONE (1) YEAR PARTS AND SEVEN (7) YEAR COMPRESSOR TO THE ORIGINAL OWNER FROM DATE OF INSTALLATION.**

- A. If the systems are:
  1. Designed by a certified CITY MULTI Diamond Designer using Diamond System Builder,
  2. Installed by a contractor that has successfully completed the Mitsubishi Electric three day service course, AND
  3. Verified with required materials submitted to and approved by the Mitsubishi Electric Service Department, which include:
    - a. As built Diamond System Builder file,
    - b. A one (1) hour Maintenance Tool record with system information, in Ordinary Control Mode (not initial),
    - c. Outdoor and Indoor unit dip switch settings
    - d. Outdoor unit(s) function settings,
- B. then the units shall be covered by an extended manufacturer's limited warranty for a period of ten (10) years to the original owner from date of installation.
- C. In addition, the compressor shall have a manufacturer's limited warranty for a period of ten (10) years to the original owner from date of installation.
- D. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer.
- E. This warranty shall not include labor.

### **2.02 MANUFACTURER SHALL HAVE A MINIMUM OF THIRTY-THREE (33) YEARS OF HVAC EXPERIENCE IN THE U.S. MARKET.**

**2.03 ALL MANUFACTURER TECHNICAL AND SERVICE MANUALS MUST BE READILY AVAILABLE FOR DOWNLOAD BY ANY LOCAL CONTRACTOR SHOULD EMERGENCY SERVICE BE REQUIRED. REGISTERING AND SIGN-IN REQUIREMENTS WHICH MAY DELAY EMERGENCY SERVICE REFERENCE ARE NOT ALLOWED.**

**2.04 THE CITY MULTI VRF SYSTEM SHALL BE INSTALLED BY A CONTRACTOR WITH EXTENSIVE CITY MULTI INSTALL AND SERVICE TRAINING. THE MANDATORY CONTRACTOR SERVICE AND INSTALL TRAINING SHOULD BE PERFORMED BY THE MANUFACTURER.**

### **PART 3 PRODUCTS**

#### **3.01 R2-SERIES Outdoor Unit**

##### **A. General:**

1. The R2-Series PURY outdoor unit shall be used specifically with CITY MULTI VRF components. The PURY outdoor units shall be equipped with multiple circuit boards that interface to the M-NET controls system and shall perform all functions necessary for operation. Each outdoor unit module shall be completely factory assembled, piped and wired and run tested at the factory.
  - a. The model nomenclature and unit requirements are shown below. All units requiring a factory supplied twinning kits shall be piped together in the field, without the need for equalizing line(s). If an alternate manufacturer is selected, any additional material, cost, and labor to install additional lines shall be incurred by the contractor.

<b>Outdoor Unit Model Nomenclature</b>		
<b>208/230 Volt</b>		<b>Twinning Kit</b>
<b>Model Number</b>	<b>Units</b>	
PUHY-P72TKMU	(1) PUHY-P72TKMU	None
PUHY-P96TKMU	(1) PUHY-P96TKMU	None
PUHY-P120TKMU	(1) PUHY-P120TKMU	None
PUHY-P144TKMU	(1) PUHY-P144TKMU	None
PUHY-P168TSKMU	(1) PUHY-P96TKMU (1) PUHY-P72TKMU	CMY-R100CBK2
PUHY-P192TSKMU	(2) PUHY-P96TKMU	CMY-R100CBK2

Outdoor Unit Model Nomenclature		
PUHY-P216TSKMU	(1) PUHY-P96TKMU (1) PUHY-P120TKMU	CMY-R100XLCBK
PUHY-P240TSKMU	(2) PUHY-P120TKMU	CMY-R100XLCBK
PUHY-P264TSKMU	(1) PUHY-P120TKMU (1) PUHY-P144TKMU	CMY-R100XLCBK
PUHY-P288TSKMU	(2) PUHY-P144TKMU	CMY-R100XLCBK

2. Outdoor unit shall have a sound rating no higher than 60 dB(A) individually or 64 dB(A) twinned. Units shall have a sound rating no higher than 50 dB(A) individually or 53 dB(A) twinned while in night mode operation. If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.
3. Both refrigerant lines from the outdoor unit to the BC (Branch Circuit) Controller (Single or Main) shall be insulated in accordance with the installation manual.
4. There shall be no more than 3 branch circuit controllers connected to any one outdoor unit.
5. Outdoor unit shall be able to connect to up to 50 indoor units depending upon model.
6. The outdoor unit shall have an accumulator with refrigerant level sensors and controls.
7. The outdoor unit shall have a high pressure safety switch, over-current protection, crankcase heater and DC bus protection.
8. The outdoor unit shall have the ability to operate with a maximum height difference of 164 feet and have total refrigerant tubing length of 1804-2625 feet. The greatest length is not to exceed 541 feet between outdoor unit and the indoor units without the need for line size changes or traps.
9. The outdoor unit shall be capable of operating in heating mode down to -4F ambient temperatures or cooling mode down to 23F ambient temperatures, without additional low ambient controls. If an alternate manufacturer is selected, any additional material, cost, and labor to meet low ambient operating condition and performance shall be incurred by the contractor.
10. The outdoor unit shall be capable of operating in cooling mode down to -10F with optional manufacturer supplied low ambient kit.
11. Manufacturer supplied low ambient kit shall be provided with predesigned control box rated for outdoor installation and capable of controlling kit operation automatically in all outdoor unit operation modes.
12. Manufacturer supplied low ambient kit shall be listed by Electrical Laboratories (ETL) and bear the ETL label.
13. Manufacturer supplied low ambient kit shall be factory tested in low ambient temperature chamber to ensure operation. Factory performance testing data shall be available when requested.
14. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.
15. The outdoor unit shall be provided with a manufacturer supplied 20 gauge hot dipped galvanized snow/hail guard. The snow/hail guard protects the outdoor coil surfaces from hail damage and snow build-up in severe climates.

16. Unit must defrost all circuits simultaneously in order to resume full heating more quickly. Partial defrost which may extend "no or reduced heating" periods shall not be allowed.
  17. Equipment must be labeled "Assembled in USA" on equipment nameplate. Manufacturer must provide documentation from U.S. Customs and Border Protection indicating the equipment is a product of the U.S.
- B. Unit Cabinet:
1. The casing(s) shall be fabricated of galvanized steel, bonderized and finished. Units cabinets shall be able to withstand 960 hours per ASTM B117 criteria for seacoast protected models (-BS models).
- C. Fan:
1. Each outdoor unit module shall be furnished with one direct drive, variable speed propeller type fan. The fan shall be factory set for operation under 0 in. WG external static pressure, but capable of normal operation under a maximum of 0.24 in. WG external static pressure via dipswitch.
  2. All fan motors shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.
  3. All fan motors shall be mounted for quiet operation.
  4. All fans shall be provided with a raised guard to prevent contact with moving parts.
  5. The outdoor unit shall have vertical discharge airflow.
- D. Refrigerant:
1. R410A refrigerant shall be required for PURY-P-T/Y(S)KMU-A outdoor unit systems.
  2. Polyolester (POE) oil shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.
- E. Coil:
1. The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
  2. The coil fins shall have a factory applied corrosion resistant blue-fin finish.
  3. The coil shall be protected with an integral metal guard.
  4. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.
  5. The outdoor coil shall include 4 circuits with two position valves for each circuit, except for the last stage.
- F. Compressor:
1. Each outdoor unit module shall be equipped with one inverter driven scroll hermetic compressor. Non inverter-driven compressors, which cause inrush current (demand charges) and require larger wire sizing, shall not be allowed.
  2. A crankcase heater(s) shall be factory mounted on the compressor(s).
  3. The outdoor unit compressor shall have an inverter to modulate capacity. The capacity shall be completely variable with a turndown of 19%-5% of rated capacity, depending upon unit size.
  4. The compressor will be equipped with an internal thermal overload.
  5. The compressor shall be mounted to avoid the transmission of vibration.
- G. Electrical:
1. The outdoor unit electrical power shall be 208/230 volts, 3-phase, 60 hertz.
  2. The outdoor unit shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz), 207-253V (230V/60Hz).
  3. The outdoor unit shall be controlled by integral microprocessors.

4. The control circuit between the indoor units, BC Controller and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

## **PART 4 CONTROLS**

### **4.01 OVERVIEW**

- A. general:
  1. The CITY MULTI Controls Network (CMCN) shall be capable of supporting remote controllers, centralized controllers, an integrated web based interface, graphical user workstation, and system integration to Building Management Systems via BACnet® and LonWorks®.

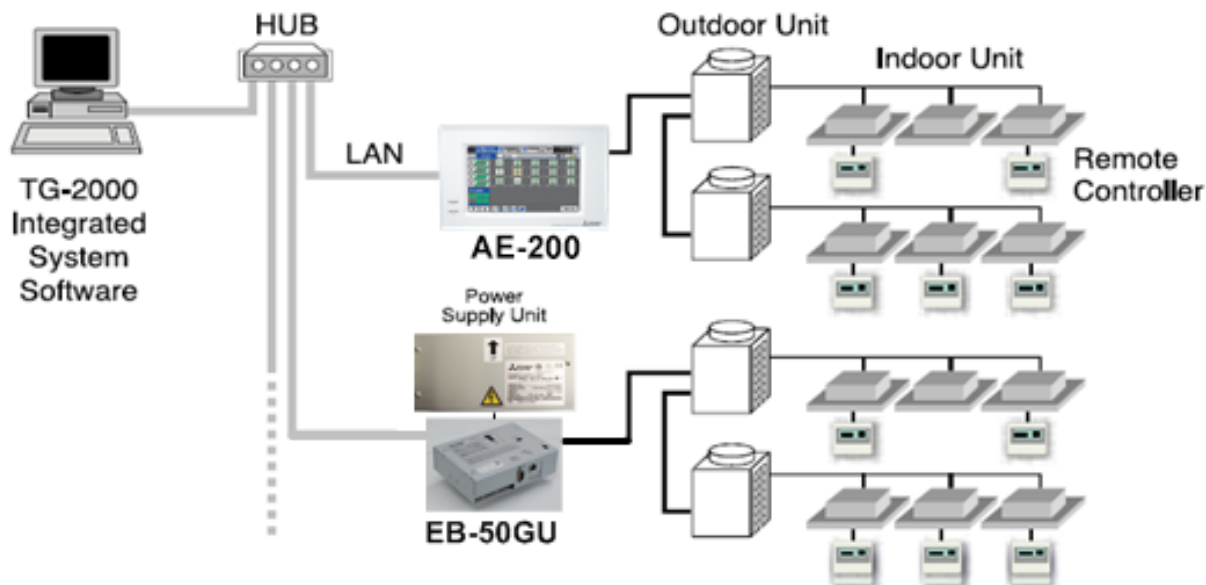
### **4.02 ELECTRICAL CHARACTERISTICS**

- A. General:
  1. The CMCN shall operate at 30VDC. Controller power and communications shall be via a common non-polar communications bus.
- B. Wiring:
  1. Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit, to the BC controller (main and subs, if applicable) and to the outdoor unit. Control wiring to remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.
  2. Control wiring for the Smart ME remote controller shall be from the remote controller to the first associated indoor unit (TB-5) M-NET connection. The Smart ME remote controller shall be assigned an M-NET address.
  3. Control wiring for the Simple MA and Wireless MA remote controllers shall be from the remote controller (receiver) to the first associated indoor unit (TB-15) then to the remaining associated indoor units (TB-15) in a daisy chain configuration.
  4. Control wiring for centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit, to the system controllers (centralized controllers and/or integrated web based interface), to the power supply.
  5. The AE-200, AE-50, and EB-50GU centralized controller shall be capable of being networked with other AE-200, AE-50, and EB-50GU centralized controllers for centralized control.
- C. Wiring Type:
  1. Wiring shall be 2-conductor (16 AWG), twisted, stranded, shielded wire as defined by the Diamond System Builder output.
  2. Network wiring shall be CAT-5 with RJ-45 connection.

### **4.03 CITY MULTI CONTROLS NETWORK**

- A. The CITY MULTI Controls Network (CMCN) consists of remote controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The CITY MULTI Controls Network shall support operation monitoring, scheduling, occupancy, error email distribution, personal web browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using either LonWorks® or BACnet® interfaces. The below figure illustrates a sample CMCN System Configuration.





B. CMCN: Remote Controllers Backlit Simple MA Remote Controller (PAC-YT53CRAU):

1. The Backlit Simple MA Remote Controller (PAC-YT53CRAU) shall be capable of controlling up to 16 indoor units (defined as 1 group). The Backlit Simple MA Remote Controller shall be compact in size, approximately 3" x 5" and have limited user functionality. The Backlit Simple MA supports temperature display selection of Fahrenheit or Celsius. The Backlit Simple MA Remote Controller shall allow the user to change on/off, mode (cool, heat, auto (R2/WR2-Series only), dry, setback (R2/WR2-Series only) and fan), temperature setting, and fan speed setting and airflow direction. The Backlit Simple MA Remote Controller shall be able to limit the set temperature range from the Backlit Simple MA. The Backlit Simple MA Remote controller shall be capable of night setback control with upper and lower set temperature settings. The room temperature shall be sensed at either the Backlit Simple MA Remote Controller or the Indoor Unit dependent on the indoor unit dipswitch setting. The Backlit Simple MA Remote Controller shall display a four-digit error code in the event of system abnormality/error.
2. The Backlit Simple MA Remote Controller shall only be used in same group with Wireless MA Remote Controllers (PAR-FL32MA-E / PAR-FA32MA-E) or with other Backlit Simple MA Remote Controllers (PAC-YT53CRAU), with up to two remote controllers per group.
3. The Backlit Simple MA Remote Controller shall require no addressing. The Backlit Simple MA Remote Controller shall connect using two-wire, stranded, non-polar control wire to TB15 connection terminal on the indoor unit. The Simple MA Remote Controller shall require cross-over wiring for grouping across indoor units.

<b>PAC-YT53CRAU (Backlit Simple MA Remote Controller)</b>			
<b>Item</b>	<b>Description</b>	<b>Operation</b>	<b>Display</b>
ON/OFF	Run and stop operation for a single group	Each Group	Each Group
Operation Mode	Switches between Cool/Drying/Auto/Fan/Heat/Setback. Operation modes vary depending on the air conditioner unit. Auto and Setback mode are available for the R2/WR2-Series only.	Each Group	Each Group

<b>PAC-YT53CRAU (Backlit Simple MA Remote Controller)</b>			
<b>Item</b>	<b>Description</b>	<b>Operation</b>	<b>Display</b>
Temperature Setting	Sets the temperature from 40°F – 95°F depending on operation mode and indoor unit.  Separate COOL and HEAT mode set points available depending on central controller and connected mechanical equipment.	Each Group	Each Group
Fan Speed Setting	Available fan speed settings depending on indoor unit.	Each Group	Each Group
Air Flow Direction Setting	Air flow direction settings vary depending on the indoor unit model.	Each Group	Each Group
Permit / Prohibit Local Operation	Individually prohibit operation of each local remote control function (Start/Stop, Change operation mode, Set temperature, Reset filter). *1: Centrally Controlled is displayed on the remote controller for prohibited functions.	N/A	Each Group *1
Display Indoor Unit Intake Temp	Measures and displays the intake temperature of the indoor unit when the indoor unit is operating.	N/A	Each Group
Display Backlight	Pressing the button lights up a backlight. The light automatically turns off after a certain period of time. (The brightness settings can be selected from Bright, Dark, and Light off.)	N/A	Each Unit
Error	When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed	N/A	Each Unit
Test Run	Operates air conditioner units in test run mode. *2 The display for test run mode will be the same as for normal start/stop (does not display "test run").	Each Group	Each Group *2
Ventilation Equipment	Up to 16 indoor units can be connected to an interlocked system that has one LOSSNAY unit.	Each Group	N/A
Set Temperature Range Limit	Set temperature range limit for cooling, heating, or auto mode.	Each Group	Each Group

#### 4.04 GRAPHICAL USER WORKSTATION SOFTWARE

- A. The Graphical User Workstation Software (TG-2000) shall require a field supplied PC.
1. The TG-2000 Integrated System Software shall enable the user to control multiple AE-200/AE-50/EB-50GU's and shall provide additional functions such as tenant billing from a single, dedicated network PC configured with the TG-2000 software. The TG-2000 configured computer shall be capable of controlling up to forty AE-200/AE-50/EB-50GU Centralized Controllers with a maximum of 2,000 indoor units across multiple CITY MULTI outdoor units. The TG-2000 software shall be required if the user wants to simultaneously control more than 1 AE-200/AE-50/EB-50GU Centralized Controllers from a single PC using a single software session. Licensing per function, per AE-200/AE-50/EB-50GU Centralized Controller shall be required for the TG-2000 software. Optional software features shall be available through the TG-2000 software including tenant billing. These optional software features shall require the TG-2000 software, advance purchase from the customer, and licensing from Mitsubishi Electric to enable feature activation.

<b>TG-2000 (Integrated System Software)</b>	
<b>Item</b>	<b>Details</b>
ON/OFF	The units can turn ON and OFF for all floors or in a block, floor, or group of units.
Operation Modes	The operation mode can be switched between COOL, DRY, FAN, AUTO, and HEAT for all floors or in a block, floor, or group of units
Temperature Setting	Sets the temperature for a single group. Range of Temperature setting from 57°F – 87°F depending on operation mode and indoor unit model.  Separate COOL and HEAT mode set points available depending on remote controller and connected mechanical equipment.
Fan Speed	The fan speed can be set to four stages for all floors or in a block, floor, or group of units
Air Direction	The air direction can be set in four vertical directions or to swing for all floors or in block, floor, or group of units. (The selectable air direction differs according to the model.)
Interlocked Unit ON/OFF LOSSNAY	If there is an interlocked unit (LOSSNAY), then the unit can be turned ON (strong/weak) or OFF for all floors or in a block, floor, or group of units. (Note that the ventilation mode cannot be selected for interlocked units.)
Local Operation Prohibit	The items for which operation with the local remote controller are to be prohibited can be selected for all floors or in a block, floor, or group of units. (The items that can be prohibited are ON/OFF, operation mode, set temperature and filter sign reset.)
Annual / Weekly Schedule	The annual/weekly schedule function can be used by registering the license. Two settings, such as seasonal settings for summer and winter, can be saved.
Power Rate Apportionment Charging	A RS-485 watt-hour meter (WHM) is connected to calculate the air conditioning charges based on the amount each tenant's air-conditioner has operated. Two charging rates can be applied per day. ***OPTIONAL TENANT BILLING SOFTWARE (SW-CHARGE) REQUIRED
History	Up to 3,000 items for the error history and up to 10,000 items for operation history can be saved. Each history file can be output as a daily report or monthly report in CSV format. (The operation history consists only of the operations carried out with the TG-2000 and is limited to some limited operation items.)
Operation Time Monitor	The cumulative operation time of each indoor unit can be viewed or output as a CSV format file. (This function is valid only when the charging function license is registered.)
Filter Sign Display Mask	The filter sign display at the remote controllers can be disabled.
Set Temperature Limit	The set temperature lower limit can be set for cooling and the upper limit for heating. (ME remote controller required)

#### 4.05 CMCN: SYSTEM INTEGRATION

- A. The CMCN shall be capable of supporting integration with Building Management Systems (BMS).
- B. LMAP04U: LonWorks® Interface
  1. The Mitsubishi Electric Cooling & Heating LonWorks® interface, LMAP04U, shall support up to fifty indoor units with a variety of network variables on a per indoor unit basis. Input variables include, but are not limited to, on/off, operation mode, fan speed, prohibit remote controller, and filter sign reset. Output variables include, but are not limited to, model size, alarm state, error code, and error address.

**4.06 POWER SUPPLY (PAC-SC51KUsA)**

- A. The power supply shall supply 24VDC (TB3) for the AE-200/AE-50/EB-50GU centralized controller and 30VDC (TB2) voltage for the central control transmission.

**PART 5 PROJECT CLOSEOUT****5.01 ACCEPTANCE TESTING**

- A. Upon completion of the installation, the Control System Contractor shall load all system software and start-up the system. The Control System Contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications.
- B. The Control System 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 DDC system operation.
- C. System Acceptance: Satisfactory completion is when the Control System 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.

**5.02 OPERATOR TRAINING**

- A. During system commissioning and at such time acceptable performance of the Control System hardware and software has been established, the Control System Contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.
- B. The Control System Contractor shall provide comprehensive training for system orientation, product maintenance and troubleshooting, programming and engineering, if not provided under a previous contract at the site using the same brand and type of controllers within the previous 3 years.
- C. The Control System Contractor shall provide instruction to the owner's designated personnel on the operation of the BMS and describe its intended use with respect to the programmed functions specified. Operator orientation of the BMS shall include, but not be limited to; the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation

**5.03 WARRANTY PERIOD SERVICES**

- A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.
- B. Within this period, upon notice by the Owner, any defects in the BMS due to faulty materials, methods of installation or workmanship shall be promptly repaired or replaced by the Installing Contractor at no expense to the Owner
- C. Maintenance of Computer Software Programs: The Installing Contractor shall maintain all software during the warranty period. In addition, all factory or sub-vendor upgrades to software shall be added to the systems, when they become available, at no additional cost. New products are not considered upgrades in this context.
- D. Maintenance of Control Hardware: The Installing Contractor shall inspect, repair, replace, adjust, and calibrate, as required, the controllers, control devices and associated peripheral units during the warranty period. The Installing Contractor shall then furnish a report describing the status of

the equipment, problem areas (if any) noticed during service work, and description of the corrective actions taken. The report shall clearly certify that all software is functioning correctly.

- E. Service Period: Calls for service by the Owner shall be honored within 24 hours and are not to be considered as part of routine maintenance.
- F. Service Documentation: A copy of the service report associated with each owner-initiated service call shall be provided to the owner.

#### **5.04 WARRANTY ACCESS**

- A. The Owner shall grant Mitsubishi Electric Professional Solutions staff remote access to the BMS. Remote access to the BMS will be provided for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period

#### **5.05 OPERATION & MAINTENANCE MANUALS**

- A. See Division 1 for requirements. O&M manuals shall include the following elements, as a minimum:
  - 1. As-built control drawings for all equipment.
  - 2. As-built Network Communications Diagram.
  - 3. General description and specifications for all components.
  - 4. Completed Performance Verification sheets.
  - 5. Completed Controller Checkout/Calibration Sheets.

**END OF SECTION**

**SECTION 26 05 00  
COMMON WORK RESULTS FOR ELECTRICAL**

**PART 1 GENERAL**

**1.01 WORK INCLUDES**

- A. The work included under this Section consists of providing all labor, materials, supervision, and construction procedures necessary for the installation of the complete electrical systems required by these specifications and/or shown on the drawings of the contract.
- B. The Contract Drawings are shown in part diagrammatic intended to convey the scope of work, indicating the intended general arrangement of equipment, conduit, and outlets. Follow the drawings in laying out the work and verify spaces for the installation of the materials and equipment based on the dimensions of actual equipment furnished. Whenever a question exists as to the exact intended location of outlets or equipment, obtain instructions from the Architect/Engineer before proceeding with the work.

**1.02 RELATED WORK**

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
  - 1. Section 26 21 16 Low-Voltage Underground Electrical Service Entrance
  - 2. Section 26 24 16 Panelboards
  - 3. Section 26 32 00 Packaged Generator Assemblies
  - 4. Section 26 36 23 Automatic Transfer Switches
  - 5. Section 26 27 26 Wiring Devices

**1.03 QUALITY ASSURANCE**

- A. Provide in accordance with Contract Documents and Specifications, Control of Work section.

**1.04 SUBMITTALS**

- A. Furnish manufacturer's product data, test reports, and materials certifications as required.
- B. Shop Drawings shall be submitted to the General Contractor who shall review and approve them prior to submittal to the Engineer for approval. Shop Drawings shall identify the specific equipment and material being supplied; the quantity being supplied; and all accessories, dimensions, descriptions, mounting and connection details, wiring diagrams, elementary control diagrams, equipment interface diagrams and any other information necessary to determine compliance with the Plans and Specifications. Fabrication and installation shall be in accordance with the approved Shop Drawings.
- C. As-built copies of all Shop Drawings shall be submitted to the Engineer.
- D. Submit copies of reports, permits, and easements necessary for installation, use, and operation.
- E. Submit copies of reports of tests, inspections, and meter readings as specified.

**1.05 COORDINATION**

- A. Coordination, Sequencing, and Scheduling: per Contract Documents and Specifications.
- B. The electrical work shall be coordinated with the Work of other trades to prevent interferences and so that the progress in construction of the building will in no

way be retarded.

- C. Coordinate with all local utility companies and make all installations for their services in accordance with all utility company requirements.
- D. Where lighting fixtures and other electrical items are shown in conflict with locations of structural members and mechanical or other equipment, furnish and install all required supports and wiring to clear the encroachment for a complete installation.
- D. Any Work installed contrary to or without acceptance by the Engineer shall be subject to change as directed by the Engineer, and no extra compensation will be allowed to the Contractor for making these changes

#### **1.06 PRODUCT DELIVERY AND STORAGE**

- A. Use all means necessary to protect electrical system materials before, during and after installation and to protect the installed Work and materials of all other trades.
- B. In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the Engineer and at no additional cost to the Owner. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such special tests as directed by the Engineer, at the cost and expense of the Contractor, or shall be replaced by the Contractor at his own expenses.
- C. Protect the Work of other trades. Restore any damage caused to other trades to the condition existing prior to damage at no additional cost to the Owner.
- D. Investigate each space in the building through which equipment must pass to reach its final location. If necessary, the manufacture shall be required to ship his material in sections sized to permit passing through such restricted areas in the building.

#### **1.07 MANUFACTURER'S NAMEPLATE**

- A. Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

#### **1.08 ARC FLASH LABEL**

- A. Provide arc flash labels for all electrical equipment with operating voltages greater than 50 volt per NEC 110.16.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. Materials and equipment shall be listed by UL unless it can be demonstrated that no UL standards exist for a specific item or class of equipment.
- B. All other materials, not specifically described but required for a complete and operable electrical installation, shall be new, first quality of their respective kinds, Specification grade or better, and as selected by the Contractor subject to the acceptance by the Engineer.
- C. All materials and equipment furnished and installed on this Project shall meet the most stringent efficiency standards of the local utility to qualify for the maximum rebate.

#### **2.02 MATERIAL AND CONSTRUCTION REQUIREMENTS**

- A. Unless otherwise shown or specified, all enclosures, motors, wiring and other materials and all construction methods shall conform to the following:
  - 1. Indoor Enclosures, NEMA 1
  - 2. Outdoor Enclosure, NEMA 3R or better.

**2.03 MISCELLANEOUS MATERIALS**

- A. Inserts, Anchors, Fasteners, and Hooks: Provide inserts, anchors, anchor bolts, lag bolts, screws, washers, nuts, hooks, and other rough hardware. Assist other trades as necessary in the placement of inserts and anchor bolts in concrete and masonry. Furnish full instructions regarding locations, sizes, and other requirements to ensure proper preparation. Provide rough hardware which complies with requirements of the governing laws and codes.

**PART 3 EXECUTION****3.01 COORDINATION**

- A. Prior to all Work of this section, carefully inspect the installed Work of all other trades and verify that all such Work is complete to the point where this installation may properly commence.
- B. Field verify all locations and dimensions to ensure that the equipment will be properly located, readily accessible, and installed in accordance with all pertinent codes and Regulations, the Contract Documents, and the referenced standards.
- C. The Work shall be carefully laid out in advance, and where cutting, drilling, etc., of floors, walls, ceilings, or other surfaces is necessary for the proper installation, this Work shall be carefully done, and any damage to building, piping, or equipment shall be repaired by mechanics of the trades involved at no additional cost to the Owner.
- D. In the event any discrepancies are discovered, immediately notify the Owner's Representative in writing. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

**3.02 INSTALLATION**

- A. Install all equipment and fixtures in complete accordance with the manufacturer's recommendations and all pertinent codes and Regulations.
- B. Thoroughly inspect all items of equipment and any items dented, scratched, or otherwise damaged in any manner shall be replaced or repaired and painted to match original finish. All items so repaired and refinished shall be brought to the attention of the Engineer for inspection and acceptance.
- C. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete or supported from or on other structural components, as they are constructed.
- D. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building and equipment which must be placed in service before further construction can take place.
- E. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
- F. The final routing of raceways shall be determined by structural conditions, interferences with other trades and by terminal locations on apparatus. The Engineer reserves the right of a reasonable amount of shifting at no extra cost up until time of roughing in the Work.
- G. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation.
- H. In general, wiring and raceway systems for security alarm, fire alarm, telephone, and intercommunications systems are not indicated on the Drawings but shall be furnished and installed under this section.
- I. Each lighting and each receptacle circuit shall have its own neutral, dedicated to that circuit. A common neutral for more than one signal phase circuit is not allowed.



- J. The Electrical Contractor shall be responsible for all cutting and patching of holes in building construction which are required for the passage of electrical work. Cutting and patching shall conform to the requirements of Division 08 and, if applicable, Division 09 of these specifications.
- K. Cutting of structural framing, walls, floors, decks and other members intended to withstand stress is not permitted.
- L. Surface mounted panel boxed, junction boxes, conduits, etc., shall be supported by spacers to provide a clearance between wall and equipment.
- M. Upon completion of all installation, lamping, and testing, thoroughly inspect all exposed portions of the electrical installation and completely remove all exposed labels, soils, markings and foreign material.

**3.03 CLEANING**

- A. Upon completion of rough electrical work in any given area, remove all rubbish and debris from the work area and leave in broom clean condition.

**END OF SECTION**

**SECTION 26 05 05  
SELECTIVE DEMOLITION FOR ELECTRICAL**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

**1.02 SUMMARY**

- A. The work of this section includes demolition of selected electrical equipment.

**1.03 QUALITY ASSURANCE**

- A. Comply with NFPA 70.
- B. Comply with NFPA 70E.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. To the extent possible reuse existing electrical materials.
- B. Remove all conductors, equipment, and associated materials that cannot be reused to a site approved to handle such waste materials.

**1.05 COORDINATION**

- A. The electrical work shall be coordinated with the Work of other trades to prevent interferences and so that the progress in construction of the building will in no way be retarded.
- B. Coordinate layout and demolition of cables with other installations.

**PART 2 PRODUCTS**

**2.01 MATERIALS AND EQUIPMENT**

- A. Materials and equipment for patching and extending work as specified in the individual sections.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify field measurements and circuiting arrangements as shown on Drawings.
- B. Verify whether PCB ballasts exist in light fixtures which will be disposed of. If PCB light fixture ballasts exist, then follow requirements in PCB BALLAST HANDLING & DISPOSAL and LAMP DISPOSAL below.
- C. Demolition Drawings are based on casual field observation and/or existing record documents. Report discrepancies to the User Agency, City Engineer, and Architect/Engineer before disturbing existing installation.
- D. Beginning of demolition means installer accepts existing conditions.

**3.02 PREPERATION**

- A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- B. Coordinate utility service outages with the User Agency, City Engineer, and Architect/Engineer.
- C. Coordinate utility service outages with the local Utility Company.
- D. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations and follow the safe working practice requirements of NFPA 70E.
- E. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from the User Agency and City Engineer at least 48 hours before partially or completely disabling

system. Minimize outage duration. If required, make temporary connections to maintain service in areas adjacent to work area.

- F. Existing Fire Alarm System: Maintain existing system in service.

### **3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK**

- A. Remove, relocate, and extend existing installations as necessary, to accommodate new construction and to meet all requirements of these specifications. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.
- B. Remove abandoned wiring to source of supply.
- C. Remove exposed abandoned conduit and abandoned conduit above accessible ceiling finishes, unless noted otherwise on drawings. Cut conduit flush with walls and floors, and patch surfaces. If certain conduits and boxes are abandoned but not scheduled for removal, they shall be shown on the "As Built Drawings".
- D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit and wiring servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
- E. Disconnect and remove abandoned panelboards and distribution equipment.
- F. Provide supplemental support for conduits that are routed through demolition area, and are to remain. Supplemental support shall be added so that the conduit meets the support requirements of electrical specification section 26 05 33.

### **3.04 PCB BALLAST HANDLING & DISPOSAL**

- A. Generally, all high power factor fluorescent light ballasts manufactured before 1978 and some HID ballasts contain polychlorinated biphenyl (PCB) compounds in their capacitors. The Contractor shall inspect all ballasts in all light fixtures and take the actions described below.
  - 1. The disposal of all ballasts labeled as "NON-PCBs" or "NO PCBs" shall become the responsibility of the Contractor. If the PCB content is not stated on the ballast label, the ballast shall be handled as a PCB ballast.
  - 2. All PCB ballasts shall be removed from the light fixtures and shall have the wires clipped off. However, before removal, all PCB ballasts shall be carefully inspected for leaks. If a ballast appears to be leaking (evidenced by potting compound leaking out or by an oily film on the ballast surface) the ballast must be handled per EPA and DNR PCB regulations. Basically, this means the ballast is to be carefully removed from the fixture and placed in an approved drum. See paragraph below for the drum specifications. The person removing the ballast from the fixture shall wear protective gloves, eye protection, and protective clothing as necessary.
  - 3. If the fixture has also been contaminated, it must be cleaned to less than 10 micrograms/100 square centimeters contamination before disposal. This cleaning must be done by an approved PCB contractor and is not considered a part of this contract. Contact DFD for contractor approval before commencing with the cleanup.
  - 4. The PCB ballasts shall then be placed in US DOT approved drums (barrels). The contractor may furnish their own drums. The quantity and size of the drums will be determined by the contractor at the time of construction, 30 and 55 gallon drums are typically available.
  - 5. These PCB drums shall be placed in storage with the cover that came with the barrels, in a location within a building, as designated by the City Engineer. The drums are not to be placed outside where they are exposed to weather.
  - 6. THESE PCB BALLASTS ARE NOT TO BE REMOVED FROM THE WORK SITE BY THE CONTRACTOR. A certified hazardous waste removal specialist should be procured for proper transportation and disposal of the ballasts.

7. The Contractor shall label and mark the PCB storage drums with EPA approved PCB labels.
8. The Contractor shall also provide approved PCB absorbent materials to be stored immediately adjacent to the drum storage area. Do not place loose absorbent material in the drums.
9. The Contractor shall provide to the DFD Field Representative, in written form, a total count of these ballasts (or their total weight by drum) and where they are stored.

### **3.05 LAMP DISPOSAL**

- A. All lamps (fluorescent, incandescent, and HID) contain mercury and/or lead (in the base) as well as other heavy metals and compounds which are regulated by the EPA and DNR during the disposal process. As a result, regulations have been issued covering the handling and disposal of all lamps. Lamps which have been removed from service for disposal shall be handled as follows by the Contractor:
  1. The Contractor shall very carefully remove all lamps (fluorescent, incandescent, and HID) from light fixtures before removal of the fixture from its mounted position. This is to reduce the likelihood that the lamp(s) will be broken. The Contractor will be charged the cost difference between disposal of broken and unbroken lamps, for all lamps broken in excess of 1% of the total lamps removed in the project.
  2. The contractor shall contact a lamp recycling vendor to coordinate the drop off of lamps. The contractor may furnish their own containers. Removed lamps shall be placed in containers by the contractor, marked with the number and type of lamp.

**END OF SECTION**

**SECTION 26 05 19**  
**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES**

**PART 1 GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

**1.02 SUMMARY**

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

**1.03 QUALITY ASSURANCE**

- A. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.
  - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
  - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- B. Comply with NFPA 70.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver wires and cables according to NEMA WC 26.

**1.05 COORDINATION**

- A. The electrical work shall be coordinated with the Work of other trades to prevent interferences and so that the progress in construction of the building will in no way be retarded.
- B. Coordinate layout and installation of cables with other installations.
- C. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Architect.

**PART 2 PRODUCTS****2.01 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Wires and Cables:
    - a. American Insulated Wire Corp.; Leviton Manufacturing Co.
    - b. Clifford Wire Company.
    - c. Carol Cable Co., Inc.
    - d. Senator Wire & Cable Company.
    - e. Southwire Company.
  - 2. Connectors for Wires and Cables:
    - a. AMP Incorporated.
    - b. General Signal; O-Z/Gedney Unit.
    - c. Monogram Co.; AFC.
    - d. Square D Co.; Anderson.
    - e. 3M Company; Electrical Products Division.

**2.02 BUILDING WIRES AND CABLES**

- A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Wire and Insulation Applications" Article.
- B. Thermoplastic Insulation Material: Comply with NEMA WC 5.
- C. Cross-Linked Polyethylene Insulation Material: Comply with NEMA WC 7.
- D. Conductor Material: Copper for all conductors.

- E. Stranding: Solid conductor for No. 10 AWG and smaller; stranded conductor for larger than No. 10 AWG.
- F. Metal Clad cable assembly (Type MC cable): MC cable use may be permitted for branch circuit wiring, but only for limited application in short connections to lighting fixtures or vibrating equipment; maximum 6 foot in length per location.

### **2.03 CONNECTORS AND SPLICES**

- A. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 "Wire and Insulation Applications" Article.
- B. All circuiting and cables shall be new. No splices shall be allowed.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine raceways and building finishes receiving wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

### **3.02 WIRE AND INSULATION APPLICATIONS**

- A. Service Entrance: Type RHW or THWN, in raceway.
- B. Feeder Circuits to Tenant Panelboards: Type THHN/THWN, in raceway, or MC Type cable assemblies.
- C. Branch Circuits: Type THHN/THWN, in raceway, or MC Type cable assemblies for limited applications as noted above.
- D. Fire Alarm Circuits: Power-limited, fire-protective, signaling circuit cable.

### **3.03 INSTALLATION**

- A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation."
- B. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to manufacturers specifications.
- F. Seal around cables penetrating fire-rated elements according to City of Portsmouth standards and practices.

### **3.04 CONNECTIONS**

- A. Conductor Splices: Cables shall not be spliced.
- B. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.
- C. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.
- D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### **3.05 FIELD QUALITY CONTROL**

- A. Testing: On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
  - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

- B. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

**END OF SECTION**

**SECTION 26 05 26**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL****1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

**1.03 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
1. Comply with UL 467.

**PART 2 PRODUCTS****2.01 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Grounding Conductors, Cables, Connectors, and Rods:
    - a. Apache Grounding/Erco Inc.
    - b. Chance/Hubbell.
    - c. Erco Inc.; Electrical Products Group.
    - d. Framatome Connectors/Burndy Electrical.
    - e. Ideal Industries, Inc.
    - f. ILSCO.
    - g. Kearney/Cooper Power Systems.
    - h. Korn: C. C. Korn Co.; Division of Robroy Industries.
    - i. O-Z/Gedney Co.; a business of the EGS Electrical Group.
    - j. Raco, Inc.; Division of Hubbell.
    - k. Thomas & Betts, Electrical.

**2.02 GROUNDING CONDUCTORS**

- A. For insulated conductors, comply with Division 26 Section 05 19 "Low Voltage Conductors and Cables."
- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Bare Copper Conductors: Comply with the following:
1. Solid Conductors: ASTM B 3.
  2. Assembly of Stranded Conductors: ASTM B 8.
  3. Tinned Conductors: ASTM B 33.
- E. 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.

**PART 3 EXECUTION**



**3.01 APPLICATION**

- 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. In raceways, use insulated equipment grounding conductors.
- C. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

**3.02 EQUIPMENT GROUNDING CONDUCTORS**

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and circuits.
- C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.
  - 4. Flexible raceway runs.
  - 5. Metal-clad cable runs.
  - 6. Motor and appliance branch circuits.

**3.03 INSTALLATION**

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- C. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, heater units, and dampers. Use braided-type bonding straps.

**3.04 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.
- 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. 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 UL 486B.
- E. 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.

**END OF SECTION**

**SECTION 26 05 33**  
**RACEWAY, CONDUIT, AND BOXES FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL****1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
  - 1. Raceways and conduit include the following:
    - a. EMT.
    - b. FMC.
    - c. Surface raceways.
  - 2. Boxes, enclosures, and cabinets include the following:
    - a. Device boxes.
    - b. Outlet boxes.
    - c. Pull and junction boxes.
    - d. Cabinets and hinged-cover enclosures.
    - e. Floor boxes
- B. Related Sections include the following:
  - 1. Division 7 Section "Firestopping."
  - 2. Division 26 Section 26 27 00 "Low-Voltage Distribution Equipment" for raceways and box supports.
  - 3. Division 26 Section 27 26 "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

**1.03 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. FMC: Flexible metal conduit.

**1.04 COORDINATION**

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

**PART 2 PRODUCTS****2.01 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Metal Conduit and Tubing:
    - a. Alflex Corp.
    - b. Anamet, Inc.; Anaconda Metal Hose.
    - c. Anixter Brothers, Inc.
    - d. Carol Cable Co., Inc.
    - e. Cole-Flex Corp.
    - f. Electri-Flex Co.
    - g. Flexcon, Inc.; Coleman Cable Systems, Inc.
    - h. Grinnell Co.; Allied Tube and Conduit Div.
    - i. Monogram Co.; AFC.
    - j. Spiraduct, Inc.
    - k. Triangle PWC, Inc.
    - l. Wheatland Tube Co.

2. Conduit Bodies and Fittings:
  - a. American Electric; Construction Materials Group.
  - b. Hubbell, Inc.; Killark Electric Manufacturing Co.
  - c. Lamson & Sessions; Carlon Electrical Products.
  - d. O-Z/Gedney; Unit of General Signal.
  - e. Scott Fetzer Co.; Adalet-PLM.
  - f. Spring City Electrical Manufacturing Co.
3. Surface Metal Raceways:
  - a. Airey-Thompson Co., Inc.; A-T Power Systems.
  - b. American Electric; Construction Materials Group.
  - c. Butler Manufacturing Co.; Walker Division.
  - d. Wiremold Co. (The); Electrical Sales Division.
4. Boxes, Enclosures, and Cabinets:
  - a. American Electric; FL Industries.
  - b. Butler Manufacturing Co.; Walker Division.
  - c. Crouse-Hinds; Div. of Cooper Industries.
  - d. Electric Panelboard Co., Inc.
  - e. Erickson Electrical Equipment Co.
  - f. Hoffman Engineering Co.; Federal-Hoffman, Inc.
  - g. Hubbell Inc.; Killark Electric Manufacturing Co.
  - h. Hubbell Inc.; Racor, Inc.
  - i. Lamson & Sessions; Carlon Electrical Products.
  - j. O-Z/Gedney; Unit of General Signal.
  - k. Parker Electrical Manufacturing Co.
  - l. Robroy Industries, Inc.; Electrical Division.
  - m. Spring City Electrical Manufacturing Co.
  - n. Thomas & Betts Corp.
  - o. RACO

## **2.02 METAL CONDUIT AND TUBING**

- A. EMT and Fittings: ANSI C80.3.
  1. Fittings: Set-screw or compression type.
- B. FMC: Zinc-coated steel.
- C. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

## **2.03 SURFACE RACEWAYS**

- A. Surface Metal Raceways: Painted steel with snap-on covers. Finish with manufacturer's standard prime coating.
- B. In places where there is an existing raceway system that is to be reused, Contractor shall match any newly installed extensions to or new supplemental nearby systems with the existing system in style, type, and size.

## **2.04 OUTLET AND DEVICE BOXES**

- A. Sheet Metal Boxes: NEMA OS 1.
- B. Cast-Metal Boxes: NEMA FB 1, Type FD, cast box with gasketed cover.

## **2.05 PULL AND JUNCTION BOXES**

- A. Small Sheet Metal Boxes: NEMA OS 1.

# **PART 3 EXECUTION**

## **3.01 EXAMINATION**

- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.02 WIRING METHODS

- A. Indoors: Use the following wiring methods:
  - 1. Exposed: EMT or MC in areas that are not having new finishes installed. To the extent possible reuse existing materials.
  - 2. Concealed: EMT in areas that are including new finishes.
  - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.
  - 4. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
    - a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.
    - b. Damp or Wet Locations: NEMA 250, Type 4, nonmetallic.
- B. Outdoors: Use the following wiring methods:
  - 1. Exposed: Rigid steel.
  - 2. Underground: Rigid steel.
  - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 4. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

### 3.03 INSTALLATION

- A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
- B. Minimum Raceway Size: 3/4-inch trade size.
- C. Conceal conduit, EMT and limited MC cable, unless otherwise indicated, within finished walls, ceilings, and floors.
- D. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- E. Install raceways level and square and at proper elevations. Provide adequate headroom.
- F. Complete raceway installation before starting conductor installation.
- G. Support raceways as specified in manufacturers installation manuals.
- H. Use temporary closures to prevent foreign matter from entering raceways.
- I. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- J. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
- K. Use raceway fittings compatible with raceways and suitable for use and location.
- L. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.
- M. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
  - 1. Run parallel or banked raceways together, on common supports where practical.
  - 2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- N. Join raceways with fittings designed and approved for the purpose and make joints tight.
  - 1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
  - 2. Use insulating bushings to protect conductors.
- O. Tighten set screws of threadless fittings with suitable tools.
- P. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.

- Q. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
- R. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of the pull wire.
- S. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
  - 1. Where conduits pass from warm to cold locations, such as the boundaries of refrigerated spaces.
  - 2. Where otherwise required by NFPA 70.
- T. Flexible Connections: Use maximum of 6 feet of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.

### **3.04 PROTECTION**

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

### **3.05 CLEANING**

- A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

**END OF SECTION**

**SECTION 26 05 33**  
**RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL****1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
  - 1. Raceways include the following:
    - a. EMT.
    - b. FMC.
    - c. Surface raceways.
  - 2. Boxes, enclosures, and cabinets include the following:
    - a. Device boxes.
    - b. Outlet boxes.
    - c. Pull and junction boxes.
    - d. Cabinets and hinged-cover enclosures.
    - e. Floor boxes
- B. Related Sections include the following:
  - 1. Division 7 Section "Firestopping."
  - 2. Division 26 Section 26 27 00 "Low-Voltage Distribution Equipment" for raceways and box supports.
  - 3. Division 26 Section 27 26 "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

**1.03 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. FMC: Flexible metal conduit.

**1.04 COORDINATION**

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

**PART 2 PRODUCTS****2.01 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Metal Conduit and Tubing:
    - a. Alflec Corp.
    - b. Anamet, Inc.; Anaconda Metal Hose.
    - c. Anixter Brothers, Inc.
    - d. Carol Cable Co., Inc.
    - e. Cole-Flex Corp.
    - f. Electri-Flex Co.
    - g. Flexcon, Inc.; Coleman Cable Systems, Inc.
    - h. Grinnell Co.; Allied Tube and Conduit Div.
    - i. Monogram Co.; AFC.
    - j. Spiraduct, Inc.
    - k. Triangle PWC, Inc.

- I. Wheatland Tube Co.
- 2. Conduit Bodies and Fittings:
  - a. American Electric; Construction Materials Group.
  - b. Hubbell, Inc.; Killark Electric Manufacturing Co.
  - c. Lamson & Sessions; Carlon Electrical Products.
  - d. O-Z/Gedney; Unit of General Signal.
  - e. Scott Fetzer Co.; Adalet-PLM.
  - f. Spring City Electrical Manufacturing Co.
- 3. Surface Metal Raceways:
  - a. Airey-Thompson Co., Inc.; A-T Power Systems.
  - b. American Electric; Construction Materials Group.
  - c. Butler Manufacturing Co.; Walker Division.
  - d. Wiremold Co. (The); Electrical Sales Division.
- 4. Boxes, Enclosures, and Cabinets:
  - a. American Electric; FL Industries.
  - b. Butler Manufacturing Co.; Walker Division.
  - c. Crouse-Hinds; Div. of Cooper Industries.
  - d. Electric Panelboard Co., Inc.
  - e. Erickson Electrical Equipment Co.
  - f. Hoffman Engineering Co.; Federal-Hoffman, Inc.
  - g. Hubbell Inc.; Killark Electric Manufacturing Co.
  - h. Hubbell Inc.; Racor, Inc.
  - i. Lamson & Sessions; Carlon Electrical Products.
  - j. O-Z/Gedney; Unit of General Signal.
  - k. Parker Electrical Manufacturing Co.
  - l. Robroy Industries, Inc.; Electrical Division.
  - m. Spring City Electrical Manufacturing Co.
  - n. Thomas & Betts Corp.
  - o. RACO

**2.02 METAL CONDUIT AND TUBING**

- A. EMT and Fittings: ANSI C80.3.
  - 1. Fittings: Set-screw or compression type.
- B. FMC: Zinc-coated steel.
- C. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

**2.03 SURFACE RACEWAYS**

- A. Surface Metal Raceways: Painted steel with snap-on covers. Finish with manufacturer's standard prime coating.
- B. In places where there is an existing raceway system that is to be reused, Contractor shall match any newly installed extensions to or new supplemental nearby systems with the existing system in style, type, and size.

**2.04 OUTLET AND DEVICE BOXES**

- A. Sheet Metal Boxes: NEMA OS 1.
- B. Cast-Metal Boxes: NEMA FB 1, Type FD, cast box with gasketed cover.

**2.05 PULL AND JUNCTION BOXES**

- A. Small Sheet Metal Boxes: NEMA OS 1.

**PART 3 EXECUTION****3.01 EXAMINATION**



- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

### **3.02 WIRING METHODS**

- A. Indoors: Use the following wiring methods:
  - 1. Exposed: EMT or MC in areas that are not having new finishes installed. To the extent possible reuse existing materials.
  - 2. Concealed: EMT in areas that are including new finishes.
  - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.
  - 4. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
    - a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.
    - b. Damp or Wet Locations: NEMA 250, Type 4, nonmetallic.
- B. Outdoors: Use the following wiring methods:
  - 1. Exposed: Rigid steel.
  - 2. Underground: Rigid steel.
  - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 4. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

### **3.03 INSTALLATION**

- A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
- B. Minimum Raceway Size: 3/4-inch trade size.
- C. Conceal conduit, EMT and limited MC cable, unless otherwise indicated, within finished walls, ceilings, and floors.
- D. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- E. Install raceways level and square and at proper elevations. Provide adequate headroom.
- F. Complete raceway installation before starting conductor installation.
- G. Support raceways as specified in manufacturers installation manuals.
- H. Use temporary closures to prevent foreign matter from entering raceways.
- I. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- J. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
- K. Use raceway fittings compatible with raceways and suitable for use and location.
- L. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.
- M. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
  - 1. Run parallel or banked raceways together, on common supports where practical.
  - 2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- N. Join raceways with fittings designed and approved for the purpose and make joints tight.
  - 1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
  - 2. Use insulating bushings to protect conductors.
- O. Tighten set screws of threadless fittings with suitable tools.
- P. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.

- Q. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
- R. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of the pull wire.
- S. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
  - 1. Where conduits pass from warm to cold locations, such as the boundaries of refrigerated spaces.
  - 2. Where otherwise required by NFPA 70.
- T. Flexible Connections: Use maximum of 6 feet of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.

**3.04 PROTECTION**

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

**3.05 CLEANING**

- A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

**END OF SECTION**

**SECTION 26 09 23**  
**LIGHTING CONTROL DEVICES**

**PART 1 - GENERAL****1.01 SUMMARY**

- A. This Section includes the following lighting control devices:
  - 1. Time switches.
  - 2. Outdoor photoelectric switches.
  - 3. Indoor occupancy sensors.
  - 4. Indoor daylighting sensors.
  - 5. Lighting contactors.
- B. See Section 26 07 26 Wiring Devices for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

**1.02 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

**1.03 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

**PART 2 - PRODUCTS****2.01 TIME SWITCHES**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Area Lighting Research, Inc.; Tyco Electronics.
  - 2. Grasslin Controls Corporation; a GE Industrial Systems Company.
  - 3. Intermatic, Inc.
  - 4. Leviton Mfg. Company Inc.
  - 5. Lightolier Controls; a Genlyte Company.
  - 6. Lithonia Lighting; Acuity Lighting Group, Inc.
  - 7. Paragon Electric Co.; Invensys Climate Controls.
  - 8. Square D; Schneider Electric.
  - 9. TORK.
  - 10. Touch-Plate, Inc.
  - 11. Watt Stopper (The).
- C. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.
  - 1. Contact Configuration: SPST.
  - 2. Contact Rating: 20-A ballast load, 120/240-V ac.
  - 3. Program: 8 on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.

4. Program: 2 on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.
  5. Programs: each channel shall be individually programmable with 8 on-off set points on a 24-hour schedule.
  6. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
  7. Astronomic Time: All channels.
  8. Battery Backup: For schedules and time clock.
- D. Substitutions: Materials shall be as specified herein, except, consideration shall be given to other products that meet or exceed those specified if requested five (5) business days prior to the date of bid opening in accordance with SECTION 01 60 00.

## **2.02 INDOOR OCCUPANCY SENSORS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell Lighting.
  2. Leviton Mfg. Company Inc.
  3. Lithonia Lighting; Acuity Lighting Group, Inc.
  4. Novitas, Inc.
  5. RAB Lighting, Inc.
  6. Sensor Switch, Inc.
  7. TORK.
  8. Watt Stopper (The).
  9. Philips Light Controls
- B. General Description: Wall- or ceiling-mounting, solid-state units with a separate 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 15 minutes.
  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
  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.
    - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
  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. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.
- C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in..
  2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot-high ceiling.
- D. Substitutions: Materials shall be as specified herein, except, consideration shall be given to other products that meet or exceed those specified if requested five (5) business days prior to the date of bid opening in accordance with SECTION 01 60 00.

## **2.03 LIGHTING CONTACTORS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. ASCO Power Technologies, LP; a division of Emerson Electric Co.
  2. Eaton Electrical Inc.; Cutler-Hammer Products.
  3. GE Industrial Systems; Total Lighting Control.
  4. Grasslin Controls Corporation; a GE Industrial Systems Company.
  5. Hubbell Lighting.
  6. Lithonia Lighting; Acuity Lighting Group, Inc.
  7. MicroLite Lighting Control Systems.
  8. Square D; Schneider Electric.
  9. TORK.
  10. Touch-Plate, Inc.
  11. Watt Stopper (The).
- B. Description: Electrically operated and electrically held, combination type with fusible switch, complying with NEMA ICS 2 and UL 508.
  1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
  2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
  3. Enclosure: Comply with NEMA 250.
  4. Provide with control and pilot devices as indicated on Drawings matching the NEMA type specified for the enclosure.
- C. Substitutions: Materials shall be as specified herein, except, consideration shall be given to other products that meet or exceed those specified if requested five (5) business days prior to the date of bid opening in accordance with SECTION 01 60 00.

## **2.04 CONDUCTORS AND CABLES**

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. [18] [22] [24] AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. [14] [16] [18] AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

## **PART 3 - EXECUTION**

### **3.01 SENSOR INSTALLATION**

- A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

- B. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

### **3.02 CONTACTOR INSTALLATION**

- A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

### **3.03 WIRING INSTALLATION**

- A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

### **3.04 IDENTIFICATION**

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
  - 1. Identify controlled circuits in lighting contactors.
  - 2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

### **3.05 FIELD QUALITY CONTROL**

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
  - 2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.

**END OF SECTION**

**SECTION 26 21 00  
LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE**

**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

**1.02 SUMMARY**

- A. Extent of service entrance work is indicated by drawings and schedules.  
Secondary conduits from Utility pole to building shall be part of Electrical Contractor's work.

**1.03 SEQUENCING AND SCHEDULING**

- A. Schedule delivery of service entrance equipment which permits ready building ingress for large equipment components to their designated installation spaces. Coordinate delivery of equipment with the installation of other building components.

**1.04 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Ensure all installations meet NECA 1 Standard for Good Workmanship in Electrical Construction.
- C. Follow NFPA 70E Standard for Electrical Safety in the Workplace.

**PART 2 - PRODUCTS****2.01 ELECTRICAL SERVICE REQUIREMENTS**

- A. See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. Retain one of three paragraphs and list of manufacturers below.  
General: Provide meter socket in NEMA 3R enclosure, which comply with requirements of local utility company supplying electrical power (Eversource) to service entrance equipment of building project.  
Manufacturers: Subject to compliance with requirements, provide meter sockets of one of the following:
  - 1. Circle AW Products Co.
  - 2. General Electric Co.
  - 3. Square D Co.
  - 4. Westinghouse

**PART 3 - EXECUTION****3.01 EXAMINATION**

- A. Examine areas and conditions under which service entrance equipment and components are to be installed, and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until satisfactory conditions have been corrected in a manner acceptable to Installer.

**3.02 UTILITY COMPANY COORDINATION**

- A. The Electric Utility Company (Eversource) shall be responsible for the following.
  - 1. Furnish and install new fuse cutouts and lighting arrestors on existing primary Utility Pole serving the new building site.
  - 2. Furnish and install new three phase pole-mounted transformers on Utility pole.
  - 3. Furnish and install underground primary service cable from Utility Pole to electrical service disconnect switch.
  - 4. Complete all final connections at pole mount transformer and meter socket.
- B. The Telecom Service:

1. Coordinate with City of Portsmouth for any special protection treatment required during construction.
- C. Contractor shall be responsible for the following:
1. Furnish and install Meter Socket, CT cabinet (if needed), and Metering conduit.
  2. Furnish and install all conduits from electric utility pole to building.
  3. Removal of existing feeder to building and existing meter on Utility pole.
  4. Furnish and install conduit up utility pole and grounding at utility pole base as directed by Utility.
- D. Contractor shall carry in his bid, all Utility Company charges, payable in advance of construction to the Utility Company. If Utilities cannot provide Contractor with anticipated charges at the time of bidding, Contractor shall so state in writing with the Contractor's bid submission.

**END OF SECTION**



**SECTION 26 27 26  
WIRING DEVICES****PART 1 - GENERAL****1.01 SUMMARY**

- A. This Section includes the following:
  - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
  - 2. Wall-box motion sensors.
  - 3. Snap switches and wall-box dimmers.
  - 4. Wall-switch and exterior occupancy sensors.
  - 5. Communications outlets.
- B. See Division 27 Section "Communications Horizontal Cabling" for workstation outlets.
- C. All devices and materials shall be Underwriter's Laboratories, (UL) listed.
- D. All devices, switches, receptacles, and cover plates shall be specification grade.

**1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.
- D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

**1.3 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

**PART 2 - PRODUCTS****2.1 WIRING DEVICES**

- A. Switches: Switches shall be composition body, flush tumbler, quiet type, side wired, toggle handle. Switches rated for 120 or 277 volts, A.C., shall be rated 20 amperes.
- B. Receptacles: Receptacles shall be duplex, quad, or as scheduled in Contract Documents, flush, straight blade, or grounding type. Duplex receptacles shall be NEMA-520R. Receptacles in damp or wet locations shall be Listed as "weatherproof". Receptacles shall be Listed as "tamperproof" in locations required by the NEC.
- C. Receptacle Color: The color of devices shall be ivory.
- D. Cover Plates, Finished Areas: Interior cover plates in finished offices, classrooms, and other general-purpose occupancies shall be brushed stainless steel. Interior cover plates in the boiler room and other potentially corrosive occupancies shall be #302/304 brushed stainless steel.
- E. Outdoor Cover Plates: All outdoor receptacle covers noted as "weatherproof" or installed outdoors shall remain rain-tight whether or not a plug and cord is inserted. Covers shall be sunlight resistant, pad lockable, polycarbonate construction.

## 2.2 GFCI RECEPTACLES

- A. General Description: Straight blade, **feed-through** type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; GF20.
    - b. Pass & Seymour; 2084.

## 2.3 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable toggle switch; with single-pole or three-way switching. Comply with UL 1472.
- C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

## 2.4 OCCUPANCY SENSORS

- A. Wall-Switch Sensors:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 6111 for 120 V, 6117 for 277 V.
    - b. Hubbell; WS1277.
    - c. Leviton; ODS 10-ID.
    - d. Pass & Seymour; WS3000.
    - e. Watt Stopper (The); WS-200.
    - f. Philips Light Controls
  - 3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft..
- B. Wall-Switch Sensors:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell; AT120 for 120 V, AT277 for 277 V.
    - b. Leviton; ODS 15-ID.
    - c. Philips Light Controls
  - 3. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft.
- C. Long-Range Wall-Switch Sensors:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell; ATP1600WRP.
    - b. Leviton; ODWWV-IRW.
    - c. Pass & Seymour; WA1001.
    - d. Watt Stopper (The); CX-100.
    - e. Philips Light Controls
  - 3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft.
- D. Long-Range Wall-Switch Sensors:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell; ATD1600WRP.
    - b. Leviton; ODW12-MRW.
    - c. Watt Stopper (The); DT-200.
    - d. Philips Light Controls
  3. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft..
- E. Wide-Range Wall-Switch Sensors:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell; ATP120HBRP.
    - b. Leviton; ODWHB-IRW.
    - c. Pass & Seymour; HS1001.
    - d. Watt Stopper (The); CX-100-3.
    - e. Philips Light Controls
  3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft.

## 2.5 COMMUNICATIONS OUTLETS

- A. Telephone Outlet:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 3560-6.
    - b. Leviton; 40649.
  3. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1 complying with Category 5e. Comply with UL 1863.
- B. Combination TV and Telephone Outlet:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 3562.
    - b. Leviton; 40595.
  3. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e; and one Type F coaxial cable connector.

## 2.6 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
  2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting
  - Material for Unfinished Spaces: Galvanized steel.
  3. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant thermoplastic with lockable cover.

## 2.7 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
  2. Wiring Devices Connected to Emergency Power System: Red.
  3. TVSS Devices: Blue.

**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
  - 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
  - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
  - 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
  - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
  - 4. Existing Conductors:
    - a. Cut back and pigtail, or replace all damaged conductors.
    - b. Straighten conductors that remain and remove corrosion and foreign matter.
    - c. Pigtail existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
  - 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
  - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
  - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
  - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
  - 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
  - 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
  - 8. Tighten unused terminal screws on the device.
  - 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
  - 1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
  - 1. Install dimmers within terms of their listing.
  - 2. Verify that dimmers used for fan speed control are listed for that application.
  - 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

**3.2 IDENTIFICATION**

- A. Comply with Division 26 Section "Identification for Electrical Systems."
  - 1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

**3.3 FIELD QUALITY CONTROL**

- A. Perform tests and inspections and prepare test reports.
  - 1. Test Instruments: Use instruments that comply with UL 1436.
  - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Tests for Convenience Receptacles:
  - 1. Line Voltage: Acceptable range is 105 to 132 V.
  - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
  - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
  - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
  - 6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

**END OF SECTION**

**SECTION 26 28 16.10  
SAFETY SWITCHES****PART 1 GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

**1.02 SUMMARY**

- A. Furnish and install safety switches of the types, sizes and quantities indicated on the contract drawings. Provide all lugs and accessories necessary for proper installation and operation.

**1.03 REFERENCES**

- A. The safety switches and all accessories shall be designed, manufactured and tested in accordance with the latest applicable standards of the following:
  - 1. UL98 – Enclosed and Dead-Front Switches
  - 2. UL50 – Enclosures for Electrical Equipment
  - 3. NEMA KS-1 for type GD and HD switches.

**1.04 SUBMITTALS**

- A. M Provide product information prior to fabrication and installation. Product data shall include all dimensions, weights, electrical ratings and replacement parts.

**1.05 DELIVERY, STORAGE AND HANDLING**

- A. Deliver materials and products in factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage from weather, excessive temperatures and construction operations.

**1.06 COORDINATION**

- A. The electrical work shall be coordinated with the Work of other trades to prevent interferences and so that the progress in construction of the building will in no way be retarded.

**PART 2 PRODUCTS****2.01 MANUFACTURERS**

- A. Acceptable manufacturers of automatic transfer switches include, but are not limited to:
  - 1. Siemens
  - 2. GE  
Eaton Cutler Hammer
  - 3. Square D

**2.02 GENERAL DUTY SAFETY SWITCHES**

- A. SWITCH MECHANISM AND HANDLE:
  - 1. Switch operating mechanism shall be non-teasible, positive, quick-make, quick-break such that during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started.
  - 2. The operating handle shall be an integral part of the box and not the cover.
  - 3. The handle position, combined with large "ON" and "OFF" lettering on the nameplate, shall clearly indicate the switch position.

4. The operating handle must be made of steel, with no plastic parts other than the handle grip.
  5. The operating mechanism must be made of steel, with no plastic parts
- B. SWITCH INTERIOR
1. All switches shall have switch blades, which are visible when the switch is OFF and the cover is open.
  2. Lugs shall be UL-listed for Cu/Al 60° or 75°C conductors in 30-60 ampere ratings and for 75°C conductors in 100-600 ampere ratings.
  3. All current carrying parts shall be plated to resist corrosion.
  4. 60 – 200A fusible switches shall have spring reinforced fuse clips.
- C. SWITCH ENCLOSURES
1. Top hinged enclosures are acceptable for 30 amp General Duty Switches only.
  2. Enclosures for Type 3R switches through 200 ampere shall have provisions of for interchangeable bolt-on hubs in the top endwall. Hubs shall be Siemens Type “ECHS” or “ECHV” hubs sized as indicated on the plans.
  3. Switches shall have wire-bending space lug capacity for one size larger Al/Cu wire than NEC and UL minimum requirements.
  4. All switch enclosures, except those for 30A General Duty Switches, shall have a formed front flange to provide additional strength and rigidity.
  5. Tangential knockouts shall be provided for switches rated 60-600A in Type 1 and 3R enclosures where permitted.
- D. SWITCH RATINGS
1. All switches shall be Underwriters’ Laboratories, Inc. listed and meet NEMA Specification KS-1.
  2. Switches shall also be horsepower rated for AC and/or DC as indicated on the plans.
  3. All switches, intended for service entrance, shall be UL approved for this application.

## **2.03 HEAVY DUTY SAFETY SWITCHES**

### **A. SWITCH MECHANISM AND HANDLE**

1. Switch operating mechanism shall be non-teasible, positive, quick-make, quick-break such that during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started.
2. The operating handle shall be an integral part of the box and not the cover.
3. The handle position, combined with large “ON” and “OFF” lettering on the nameplate, shall clearly indicate the switch position.
4. The operating handle of Type 1, 3R, 12 and stainless 4X switches must be made of steel, with no plastic parts other than the handle grip. NEMA 4X switches with non-metallic enclosures shall have non-metallic operating handles.
5. The operating handle of a heavy duty safety switch shall be provided with a highly visible red plastic grip and must allow for hook stick operation.
6. The operating mechanism must be made of steel, with no plastic parts.
7. All heavy duty switches shall have a dual cover interlock mechanism to prevent unintentional opening of the switch cover when the switch is ON and prevent turning the switch ON when the cover is open. The cover interlock mechanism shall have an externally operated override but the override shall not permanently disable the interlock mechanism. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.
8. 30-200A 4X stainless steel switches shall have stainless steel interior parts as standard.

9. All switches shall have provisions to accept up to three 5/16 in. hasp padlocks to lock the operating handle in the OFF position.
- B. SWITCH INTERIOR
  1. All switches shall have switch blades, which are visible when the switch is OFF and the cover is open.
  2. Lugs shall be front removable and UL-listed for Cu/Al 60° or 75°C conductors in 30-100 ampere ratings and for 75°C conductors in 200-1200 ampere ratings. Line and load lugs shall be removable with no need to remove line shields and arc suppressors.
  3. 30 to 100 ampere switches shall be capable of accepting field installed fuse puller kits.
  4. Optional copper body and crimp type lugs are to be UL approved for field installation in 30-600A ratings.
  5. Heavy Duty Switches all shall have all copper current carrying parts other than standard aluminum alloy lugs.
  6. All current carrying parts shall be plated to resist corrosion.
  7. Heavy Duty Switches shall have provisions for field installable auxiliary switches. There also must low current PLC type auxiliary interlock available for 30-200A switches.
  8. All switches shall have spring reinforced fuse clips.
- C. SWITCH ENCLOSURES
  1. Heavy duty switch covers shall be attached with pin-type hinges. Except for outdoor General Duty 30A switches, top hinged doors are not acceptable.
  2. Enclosures for Type 3R switches through 200 ampere shall have provisions of for interchangeable bolt-on hubs in the top endwall. Hubs shall be Siemens Type "ECHS" or "ECHV" hubs sized as indicated on the plans.
  3. Switches shall have wire-bending space lug capacity for one size larger Al/Cu wire than NEC and UL minimum requirements.
  4. All switch enclosures, except those for 30A General Duty Switches, shall have a formed front flange to provide additional strength and rigidity.
  5. Tangential knockouts shall be provided for switches rated 30-600A in Type 1 and 3R enclosures where permitted.
  6. Cover latching means for Type 4 / 4X & 12 switches in metal enclosures rated through 1200 amperes shall be quick release lift lever type.
  7. Type 12 enclosures shall be dual rated as Type 3S to allow their use in outdoor applications.
  8. Cover viewing window shall be an available option on 30-400A NEMA 12 and 4 / 4X stainless steel switches. The window must allow viewing of indicating fuses in 30-200A ratings.
  9. All heavy duty switches shall have either metal or plastic nameplates.
- D. SWITCH RATINGS
  1. All switches shall be Underwriters' Laboratories, Inc. listed and meet NEMA Specification KS-1.
  2. Switches shall also be horsepower rated for AC and/or DC as indicated on the plans.
  3. All switches, intended for service entrance, shall be UL approved for this application.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged automatic transfer switch.



- B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before automatic transfer switch installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.02 ADJUSTMENTS AND CLEANING**

- A. The contractor shall install the necessary accessories in order to place the safety switches in final operating condition.

**3.03 TESTING**

- A. Perform factory and installation tests in accordance with applicable NEC, NEMA and UL requirements.

**3.04 WARRANTY**

- A. Equipment manufacturer warrants that all goods supplied are free of non-conformities in workmanship and materials for one year from date of initial operation, but not more than eighteen months from date of shipment.

**3.05 INSTALLATION**

- A. Where the specifications call for an installation to be made in accordance with Manufacturer's recommendations, a copy of such recommendations shall at all times be kept in the job superintendent's office and shall be available to the Owner's Representative.

**END OF SECTION**

**SECTION 26 32 13  
ENGINE GENERATORS**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

**1.02 SUMMARY**

- A. Section includes packaged engine-generator sets for optional standby power supply with the following features.
1. Gas engine.
  2. Unit-mounted cooling system.
  3. Unit-mounted control and monitoring.
  4. Performance requirements for sensitive loads.
  5. Fuel system.
  6. Outdoor enclosure.
- B. Related Requirements:
1. Section 26 36 00 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

**1.03 SUBMITTALS**

- A. Product Data: For each type of product.
1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
  2. Include thermal damage curve for generator.
  3. Include time-current characteristic curves for generator protective device.
  4. Include fuel consumption in cubic feet per hour at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
  5. Include generator efficiency at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
  6. Include air flow requirements for cooling and combustion air in cfm at 0.8 power factor and rated load. Testing shall be performed per ISO3046 standards. Provide drawings showing requirements and limitations for location of air intake and exhausts.
  7. Include generator characteristics, including, but not limited to kw rating, efficiency, reactance's, and short-circuit current capability.
- B. Shop Drawings:
1. Include plans and elevations for engine-generator set and other components specified. Indicate access requirements affected by height of subbase fuel tank.
  2. Include details of equipment assemblies. Indicate dimensions, weights, center of gravity of full assembly, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  3. Identify fluid drain ports and clearance requirements for proper fluid drain.
- C. Source quality-control reports, including, but not limited to the following:
1. Certified summary of prototype-unit test report.
  2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
  3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.

4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
  5. Report of sound generation.
  6. Report of exhaust emissions showing compliance with applicable regulations.
  7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.
- D. Closeout submittals
1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
  2. Operating instructions laminated and mounted adjacent to generator location.  
Training plan.

#### **1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Manufacturer accepted as an ISO9001 manufacturer.
- B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved by manufacturer.
- C. Third-Party Testing Agency Qualifications: Member company of NETA or an NRTL.
  1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

#### **1.05 COORDINATION**

- A. The electrical work shall be coordinated with the Work of other trades to prevent interferences and so that the progress in construction of the building will in no way be retarded.

#### **1.06 WARRANTY**

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
  1. Warranty Period: 2 years from date of Substantial Completion.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Generac Power Systems, Inc; Natural Gas model SG 175 generator set, rated 175 kW, 120/208V 3 phase, 60 hz (the total project design scope consists of one unit with a total kW of 175 kW), or a comparable product by one of the following:
  1. Caterpillar
  2. Kohler
  3. Cummins-Onan
- B. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer. Generator set shall be standard offering from manufacturer. No special ratings will be permitted.
- C. Engineering changes resulting from the substitution of another product will be the responsibility of the electrical contractor.

#### **2.02 PERFORMANCE REQUIREMENTS**

- A. NFPA Compliance:
  1. Comply with NFPA 37.
  2. Comply with NFPA 70.
  3. Comply with NFPA 110 requirements for Level 2 emergency power supply system.
- B. UL Compliance: Comply with UL 2200/CSA.
- C. Engine Exhaust Emissions: Comply with EPA Tier requirements and applicable state and local government requirements.

- D. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.
- E. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
  - 1. Ambient Temperature: 5 to 40 deg C for spark-ignited.
  - 2. Relative Humidity: Zero to 95 percent.
  - 3. Altitude: Sea level to 1000 feet (300 m)

## **2.03 ASSEMBLY DESCRIPTION**

- A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
- C. Governor: Adjustable isochronous, with speed sensing.
- D. Emissions: Comply with EPA Tier and local requirements for standby generation.
- E. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.
- F. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.
  - 1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.
- G. Capacities and Characteristics:
  - 1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries.
  - 2. Output Connections: Three-phase, fourwire.
  - 3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component. Nameplate shall be in accordance with NFPA70.
- H. Generator-Set Performance:
  - 1. Oversizing alternator compared with the rated power output of the engine is permissible to meet specified performance.
    - a. Nameplate Data for Oversized Generator: Show ratings required by the Contract Documents rather than ratings that would normally be applied to generator size installed.
  - 2. Steady-State Voltage Operational Bandwidth: 1 percent of rated output voltage from no load to full load.
  - 3. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 5 seconds.
  - 4. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
  - 5. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.

6. Transient Frequency Performance: Less than 5-Hz variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within 5 seconds.
7. Output Waveform: At no load, harmonic content measured line to neutral shall not exceed 2 percent total with no slot ripple. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
8. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or other generator system components.
9. Block Load Performance: per NFPA110, the unit shall be able to fully recover from a 100% block load.
10. Excitation System: Performance shall be unaffected by 10% total voltage distortion (THD) caused by nonlinear load.
  - a. Provide permanent magnet excitation (PMG) for power source to voltage regulator.
11. Start Time: Comply with NFPA 110, Type 10, system requirements.

#### **2.04 Engine**

- A. Fuel: Natural gas.
- B. Engine Rating: Prime mover shall have adequate horsepower to meet the specified kW at the specified site altitude and temperatures. Products that de-rate below specified kW for temperature or altitude shall not be accepted.
- C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).
- D. Lubrication System: The following items are mounted on engine or skid:
  1. Filter and Strainer: Per manufacturer recommendations.
  2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
  3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- E. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
  1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
  2. Cooling System Sizing: Sized to adequately cool the generator set, including aftercooler, without de-rate to an ambient temperature of 104 deg F (40 deg C) for gas. Maximum external restriction shall be no greater than 0.5 inch (12.7 mm) of water column.
  3. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
  4. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
  5. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
  6. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric:
    - a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.

- b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
- F. Air-Intake Filter: Engine-mounted air cleaner with replaceable dry-filter element.
- G. Starting System: 24-V electric, with negative ground.
  - 1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
  - 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
  - 3. Cranking Cycle: As required by NFPA 110 for system level specified.
  - 4. Battery: Lead acid, certified to meet NFPA 110, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least [twice] [three times] without recharging.
  - 5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
  - 6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in "Performance Requirements" Article. Include accessories required to support and fasten batteries in place. Provide ventilation to exhaust battery gases.
  - 7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and continuous rating adequate for batteries provided.
  - 8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and include the following features:
    - a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
    - b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg F (minus 40 deg C) to 140 deg F (60 deg C) to prevent overcharging at high temperatures and undercharging at low temperatures.
    - c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
    - d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
    - e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
    - f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet with adequate vibration isolation if mounted within the generator set.
    - g. Battery chargers mounted within the Automatic Transfer Switch are not acceptable

## **2.05 GASEOUS FUEL SYSTEM**

- A. Natural-Gas Piping: Comply with requirements in Section 231123 "Facility Natural-Gas Piping" and with requirements of NFPA 37 and 54.
  - 1. Gas piping is the responsibility of the installing contractor.

2. Gas piping shall be sized to provide adequate fuel to the engine while allowing for no greater than 1 inch (25 mm) water column pressure drop from no load to full load.
  3. Natural gas piping will supply pressure to the generator set inlet per manufacturer's recommendations, nominally 11 to 14 inches (279.4 to 356 mm) of water column.
  4. Natural gas regulator shall be sized to provide 125 percent of full-load generator set capacity.
- B. Gas Train: Comply with NFPA 37.
- C. Engine Fuel System:
1. Natural-Gas, Vapor-Withdrawal System:
    - a. Carburetor.
    - b. Secondary Gas Regulators: One for each fuel type, with atmospheric vents piped to building exterior.
    - c. Fuel-Shutoff Solenoid Valves: NRTL-listed, normally closed, safety shutoff valves; one for each fuel source.
    - d. Fuel Filters: One for each fuel type.
    - e. Manual Fuel Shutoff Valves: One for each fuel type.
    - f. Flexible Fuel Connectors: Minimum one for each fuel connection.

## **2.06 CONTROL AND MONITORING**

- A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the manual position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.
- B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the manual position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.
- C. Provide minimum run time control set for [15] <Insert number> minutes with override only by operation of a remote emergency-stop switch.
- D. Comply with UL 508A.
- E. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages 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. Panel shall be powered from the engine-generator set battery.
1. Engine and generator control wiring shall be multi-stranded annealed copper conductors encased by cross-linked polyethylene insulation resistant to heat, abrasion, oil, water, diesel fuel, and antifreeze. Wiring shall be suitable for continuous use at 250 deg F (121 deg C) with insulation not brittle at minus 60 deg F (minus 51 deg C). Cables shall be enclosed in nylon flexible conduit, which is slotted to allow easy access and moisture to escape.
    - a. Engines that are equipped with an electronic engine control module (ECM) shall monitor and control engine functionality and seamlessly integrate with the generator set controller through digital communications. ECM monitored parameters shall be integrated into the genset controllers NFPA 110 alarm and warning requirements.

- b. For engines without ECM functionality or for any additional generator set controller monitoring, sensors are to be conditioned to a 4 to 20 ma signal level to enhance noise immunity and all sensor connections shall be sealed to prevent corrosion.
- 2. Construction: All circuitry within the control panel shall be individually environmentally sealed to prevent corrosion. Encapsulated circuit boards with surface mounted components and sealed, automotive-style connectors for sensors and circuit board connectors. Enclosed circuit boards and terminal strips that are susceptible to corrosion are not acceptable.
- 3. Custom ladder logic functionality inside the generator controller shall be supported to provide application support flexibility. The ladder logic function shall have access to all the controller inputs and customer assignable outputs.
- F. Indicating Devices: As required by NFPA 110 for Level 2 system. All ECM fault codes shall be displayed at the generator set controller in standard language; fault code numbers are not acceptable. Utilizing a digital display, including the following:
  - 1. AC voltage: True three-phase sensing.
  - 2. AC current.
  - 3. Frequency.
  - 4. EPS supplying load indicator.
  - 5. DC voltage (alternator battery charging).
  - 6. Engine-coolant temperature.
  - 7. Engine lubricating-oil pressure.
  - 8. Running-time meter.
  - 9. Current and Potential Transformers: Instrument accuracy class.
- G. Protective Devices and Controls in Local Control Panel: Shutdown devices and common visual alarm indication as required by NFPA 110 for Level 2 system, including the following:
  - 1. Start-stop switch.
  - 2. Overcrank shutdown device.
  - 3. Overspeed shutdown device.
  - 4. Coolant high-temperature shutdown device.
  - 5. Coolant low-level shutdown device.
  - 6. Low lube oil pressure shutdown device.
  - 7. Overcrank alarm.
  - 8. Overspeed alarm.
  - 9. Coolant high-temperature alarm.
  - 10. Coolant low-temperature alarm.
  - 11. Coolant low-level alarm.
  - 12. Low lube oil pressure alarm.
  - 13. Lamp test.
  - 14. Contacts for local and remote common alarm.
  - 15. Coolant high-temperature prealarm.
  - 16. Generator-voltage; digitally adjustable via controller, password protected.
  - 17. Main fuel tank low-level alarm.
    - a. Low fuel level alarm shall be initiated when the level falls below that required for operation for the duration required in "Fuel Tank Capacity" Paragraph in "Diesel Fuel-Oil System" Article.
  - 18. Run-Off-Manual selector switch.
  - 19. Control switch not in automatic position alarm.
  - 20. Low cranking voltage alarm.
  - 21. Battery-charger malfunction alarm.



- 22. Battery low-voltage alarm.
- 23. Battery high-voltage alarm.
- 24. Generator overcurrent protective device not closed alarm.
- H. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated. Sensors are to be conditioned to a 4 to 20 mA signal level to enhance noise immunity and all sensor connections shall be sealed to prevent corrossions.
- I. The control system shall provide pre-wired customer use I/O: 4 relay outputs (user definable functions), 4 contact inputs, 2 analog inputs, communications support via RS232, RS485, or an optional modem. Additional I/O must be an available option. Customer I/O shall be software configurable providing full access to all alarm, event, data logging, and shutdown functionality.
- J. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.
- K. Maintenance:
  - 1. All engine, voltage regulator, control panel, and accessory units shall be accessible through a single electronic service tool. The following maintenance functionality shall be integral to the generator set controls:
    - a. Engine running hours.
    - b. Service maintenance interval (running hours, calendar days).
    - c. Engine crank attempt counter.
    - d. Engine successful starts counter.
    - e. 20 events are stored in control panel memory.
    - f. Control panel shall time and date stamp all alarms and warnings. A snap shot of key parameters shall be saved in the control panel for use in troubleshooting alarms.
    - g. A predictive maintenance algorithm will determine the optimal time for maintenance service based on the generator loading and operation.
- L. Programmable Cycle Timer: To start and run the generator for a predetermined time. The timer shall use 14 user-programmable sequences that are repeated in a 7-day cycle. Each sequence shall have the following programmable set points:
  - 1. Day of the week.
  - 2. Time of the day start.
  - 3. Duration of cycle.
  - 4. Option to exercise at reduced speed for quiet test mode.
- M. Monitoring Software: Provide monitoring software capable of communicating to no less than 15 generator sets. Software shall be connectable via RS232 connection directly on the generator control panel. Software functionality to include:
  - 1. Display generator set operating parameters including necessary pressures and temperatures, electrical output, fuel level.
  - 2. Ability to program custom I/O alarms as well as modify standard alarm settings for applications (password protected).
  - 3. Data logging and trending of up to 15 parameters, user selectable, for testing, troubleshooting, and record keeping.
  - 4. High speed data logging and trending of up to 0.2 millisecond providing sine wave visibility for testing and identification of harmonic distortion levels.

## **2.07 GENERATOR OVERCURRENT AND FAULT PROTECTION**

- A. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.
  - 1. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel and each located in a separate box per NEC700 separation of circuits.
- B. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with UL 489.
  - 1. Tripping Characteristic: Designed specifically for generator protection.
  - 2. Trip Rating: Matched to generator output rating.
  - 3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
  - 4. Mounting: Each circuit breaker installed in separate box in accordance with NEC700 separation of circuits.
- C. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector performs the following functions:
  - 1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms. Contacts shall be available for load shed functions.
  - 2. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
  - 3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
  - 4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

## **2.08 GENERATOR, EXCITER, AND VOLTAGE REGULATOR**

- A. Comply with NEMA MG 1 and UL2200, sized for 248 deg F (120 deg C) temperature rise above ambient at rated load.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required. Provide six lead alternator.
- E. Winding Coils: Skewed to improve sine wave shape and eliminate ripple effects caused by air gaps.
- F. Range: Provide broad range of output voltage by adjusting the excitation level.
- G. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rated speed, and heat during operation at 110 percent of rated capacity.
- H. Enclosure: Dripproof.
- I. Instrument Transformers: Mounted within generator enclosure.
- J. Voltage Regulator: Solid-state type on a sealed circuit board, separate from exciter, providing performance as specified and as required by NFPA 110. Must be 3-phase sensing.

1. Voltage Adjustment on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.
  2. Provide anti-hunt provision to stabilize voltage.
- K. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
- L. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- M. Subtransient Reactance: 15 percent, maximum.
- N. Excitation: Permanent magnet (PMG) type providing 300 percent current output for up to 10 seconds to a downstream breaker selective coordination and improved motor starting.

## **2.09 OUTDOOR GENERATOR-SET ENCLOSURE**

- A. Description: OEM Factory manufactured, vandal-resistant, sound-attenuating, weatherproof steel housing, wind resistant up to 100 mph (160 km/h). Multiple panels shall be locakable and provide adequate access to components requiring maintenance. Panel shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.
1. Structural Design and Anchorage: Comply with ASCE 7 for wind loads up to 100 mph (160 km/h).
  2. Fire Protection: Provide fire protection in accordance with [Section 211316 "Dry-Pipe Sprinkler Systems."] [Section 211313 "Wet-Pipe Sprinkler Systems."] Provide smoke detector in enclosure; mounted according to NFPA 72.
  3. Hinged Doors:
    - a. Door Panels: With integral stiffeners, and capable of being removed by one person without tools.
    - b. Slip-pin hinges and latches stainless steel with nylon spacers.
    - c. Gasketed for weather and rodent protection.
    - d. Handles to have padlocking provisions.
  4. Space Heater: Thermostatically controlled and sized to prevent condensation. Provide as needed to meet NFPA110, Level 1 temperature levels.
  5. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine-generator-set components.
  6. Muffler Location: [Within] [External to] enclosure. All exhaust piping shall be wrapped for personnel protection and to eliminate excessive heat build up during generator operation.
  7. Assembly Hardware (Nuts and Bolts): Use JS500 and nylon washers to prevent paint deterioration.
- B. Sound Attenuation: Factory enclosure, designed to meet the following design criteria:
1. Weather protective enclosure limiting sound emissions to 85 dB(A) at 23 ft (7 m) in a free field environment.
- C. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
- D. Convenience Outlets: Factory wired, GFCI. Arrange for external electrical connection.

## **2.10 FINISHES**

- A. Outdoor Enclosures and Components: Electrostatically applied Rhino Coat finish over corrosion-resistant pretreatment and compatible primer.
- B. Powdercoated paint surfaces, meeting the following applicable standards:
  - 1. Paint Thickness: More than 2.5 mil per ASTM D 1186.87.
  - 2. Material Hardness: ASTM D 3363-92a.
  - 3. Resistance to Cracking: ASTM D 522-B.
  - 4. Paint Adhesion: ASTM D 3359-B.
  - 5. Resistance to Salt Water Corrosion: ASTM B 117 or ASTM D 1654.
  - 6. Resistance to Humidity: ASTM D 1735 or ASTM D 1654.
  - 7. Impact Resistance: ASTM 2784.
  - 8. UV Protection: SAE J1690.

## 2.11 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
  - 1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.
- B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPERATION

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
  - 1. Notify Construction Manager no fewer than two working days in advance of proposed interruption of electrical service.
  - 2. Do not proceed with interruption of electrical service without Construction Manager's written permission.

### 3.03 INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.
- B. Equipment Mounting:
  - 1. Install packaged engine generators on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in [Section 033000 "Cast-in-Place Concrete."
  - 2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- C. Install packaged engine-generator to provide access, without removing connections or accessories, for periodic maintenance.

- D. Install engine-generator in a walk-in enclosure with elastomeric isolator pads having a minimum deflection of 1 inch (25 mm) on 4-inch- (100-mm-) high concrete base. Secure enclosure to anchor bolts installed in concrete bases.
- E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

### **3.04 CONNECTIONS**

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.
- B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine-generator to allow service and maintenance.
- C. Connect engine exhaust pipe to engine with flexible connector.
- D. Connect fuel piping to engines with a gate valve and union and flexible connector.
  - 1. Natural-gas piping, valves, and specialties for gas distribution are specified in Section 231123 "Facility Natural-Gas Piping."
  - 2. Install manual shutoff valve in a remote location to isolate natural-gas supply to the generator enclosure.
  - 3. Vent gas pressure regulators outside building a minimum of 60 inches (1500 mm) from building openings.
- E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90 degree bend in flexible conduit routed to the generator set from a stationary element.
- G. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

### **3.05 IDENTIFICATION**

- A. Identify system components according to Section 230553 "Identification for HVAC Piping and Equipment".
- B. Install a sign indicating the generator neutral is bonded to the main service neutral at the main service location.

### **3.06 FIELD QUALITY CONTROL**

- A. Testing Agency: At the owner's request, the contractor shall engage a qualified, third-party, testing agency to witness tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections.
- D. Tests and Inspections:
  - 1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in the first two subparagraphs as specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
    - a. Visual and Mechanical Inspection
      - 1. Compare equipment nameplate data with drawings and specifications.
      - 2. Inspect physical and mechanical condition.
      - 3. Inspect anchorage, alignment, and grounding.

4. Verify the unit is clean.
  - b. Electrical and Mechanical Tests
    1. Test protective relay devices per manufacturer recommendations.
    2. Verify phase rotation, phasing, and synchronized operation as required by the application.
    3. Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
    4. Conduct performance test in accordance with NFPA 110.
    5. Verify correct functioning of the governor and regulator.
2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
  - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
  - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
  - c. Verify acceptance of charge for each element of the battery after discharge.
  - d. Verify that measurements are within manufacturer's specifications.
4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
6. Voltage and Frequency Transient Stability Tests: Use data capture from manufacturer control panel and software to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
- E. Coordinate tests with tests for transfer switches and run them concurrently.
- F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.
- G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- H. Remove and replace malfunctioning units and retest/reinspect as specified above.
- I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

### **3.07 MAINTENANCE SERVICE**

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide 60 months' full maintenance by EGSA Certified employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

### **3.08 TRAINING**

- A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner.

**END OF SECTION**

**SECTION 26 36 23**  
**AUTOMATIC TRANSFER SWITCH**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

**1.02 SUMMARY**

- A. Furnish and install automatic transfer switch (ATS) with number of poles, amperage, voltage and withstand current ratings as shown on the plans. The automatic transfer shall consist of an inherently double throw power transfer switch unit and a control module interconnected to provide complete automatic operation. The transfer switch and control module shall be the product of the same manufacturer.

**1.03 REFERENCES**

- A. The automatic transfer switch and accessories shall conform to the requirements of:
1. UL 1008 - Standard for Automatic Transfer Switches
  2. NFPA 110 - Emergency and Standby Power Systems
  3. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
  4. NEMA Standard ICS10-2015 Part 4 - Low Voltage Automatic Transfer Switches

**1.04 SUBMITTALS**

- A. Manufacturer's installation and maintenance instructions.
- B. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
- C. Complete bill of material listing all components.
- D. Warranty.
- E. AIC rating.
- F. Nameplate legends.
- G. Dimensions and configurations of transfer switches shall conform to the space allocated on the Drawings. The Contractor shall submit a revised layout if equipment furnished varies in size from that indicated on Drawings for the Engineer's approval.

**1.05 QUALITY ASSURANCE**

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.
- C. Manufacturer qualifications: Firms regularly engaged in manufacture of transfer switches, of types and sizes required and whose products have been in satisfactory use in similar service for not less than 5 years.
- D. Installer's qualifications: Firms with at least 5 years of successful installation experience with Projects utilizing transfer switches similar to that required for this Project.

**1.06 COORDINATION**

- A. The electrical work shall be coordinated with the Work of other trades to prevent interferences and so that the progress in construction of the building will in no way be retarded.



**1.07 WARRANTY**

- A. Units and components offered under this Section shall be covered by a five year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

**1.08 FACTORY TEST**

- A. The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements. Transfer switch shall be completely assembled, wired, adjusted and tested, per ANSI C37.20, at the factory under simulated service conditions to assure the accuracy of the wiring and the functioning of all equipment. Factory test report containing documentation and measurements shall be included in Operation and Maintenance Manual.
- B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

**PART 2 PRODUCTS****2.01 MANUFACTURERS**

- A. Acceptable manufacturers of automatic transfer switches include, but are not limited to:
  - 1. Generac
  - 2. Kohler
  - 3. Cummins-Onan
  - 4. ASCO
  - 5. Russelectric

**2.02 PERFORMANCE REQUIREMENTS**

- A. The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a dual motor operated mechanism, momentarily energized from the source to which the load is to be transferred. The switch shall be double throw type and mechanically interlocked to ensure only one of three possible positions, normal, neutral or emergency.
- B. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.
- C. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.
- D. Transfer switch ratings:
  - 1. Voltage: 208/120volts, 3 phase, 4 wire, 60 Hz.
  - 2. Switched poles: 3-pole, solid neutral, or 4-pole, switched neutral.
  - 3. Switch operation: Open transition.
  - 4. Continuous rating: 600 Amperes or as indicated on the Drawings.
  - 5. Interrupting capacity: 100 percent of continuous rating.
  - 6. Withstand current rating: UL-1008; rated to withstand the available RMS symmetrical short circuit current. Rating shall match or exceed the value indicated on Drawings at distribution equipment serving transfer switch (on utility service side).

- E. The ATS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 1½ and 3 cycle, long-time ratings.
- F. The ATS shall be equipped with a safe manual operator, permanently attached to the motor operator, designed to prevent injury to operating personnel. The manual operator shall provide the same contact-to-contact transfer speed as the electrical operator to prevent a flashover from switching the main contacts slowly.
- G. The ATS control section shall be supplied with a protective cover and be mounted at a location within the transfer switch enclosure suitable for ease of maintenance. Sensing and control logic shall be solid-state type. Printed circuit boards shall be keyed to prevent incorrect installation. Interfacing relays shall be industrial control grade plug-in type with dust covers.
- H. All control relays shall be continuous duty; industrial type with wiping contacts rated at least 10 amperes.
- I. The thermal capacity of the main contacts shall not be less than 20 times the continuous duty rating for a minimum of 3 electrical cycles as established by certified test data.

### **2.03 ENCLOSURE**

- A. The ATS shall be furnished in a NEMA type 12 enclosure for indoor installation or NEMA 3R for outdoor installation unless otherwise shown on the plans. The ATS shall be a lockable, ventilated or non-ventilated, wall or floor mounted smooth sheet metal enclosure constructed in accordance with UL 1008.
- B. For outdoor enclosures provide non-walk-in type housing with hinged lockable access doors. Each section shall have a minimum of 13-inch deep vestibule. Provide a latch for each door to insure adequate closing pressure to seal against harmful weather.
- C. Provide each weatherproof housing with the following items power obtained from a control power transformer and circuit breaker within switch:
  - 1. Thermostatically controlled space heater.
  - 2. One 120 VAC GFCI type duplex outlet with weatherproof cover. Connect to 120 VAC light circuit.
  - 3. The weatherproof housings shall be provided with lifting eyes.

### **2.04 Operation**

- A. Voltage and Frequency Sensing
  - 1. The voltage of each phase of the normal source shall be monitored, with pickup adjustable from 85% to 95% of nominal and dropout adjustable from 75% to 95% of pickup setting.
  - 2. Single-phase voltage sensing of the emergency source shall be provided, with pickup voltage adjustable from 85% to 95% of nominal and independent frequency sensing with pickup adjustable from 80% to 90% of nominal.
  - 3. Repetitive accuracy of all settings shall be within ± 2% over an operating temperature range of -20° C to 70° C.
- B. Time Delays:
  - 1. The settings below shall be adjustable without the use of tools and shall be pre-set at the factory.
  - 2. A time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Adjustable from 0 to 10 seconds. Set at 2 seconds.
  - 3. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 seconds for controlled timing of transfer of loads to emergency. Set at 0 seconds.

4. A time delay shall be provided on retransfer to normal, adjustable from 0 to 30 minutes. Set at 30 minutes. Any momentary dips in the line will cause the time delay to reset and start its time cycle over. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable. Provide a pushbutton switch for manual transfer to normal to bypass the time delay. However, if the normal source fails, retransfer to emergency source should be automatic if the emergency source is available. Pushbutton shall be mounted to the front cover.
5. A time delay shall be provided on shutdown of engine generator for cooldown, adjustable from 0 to 60 minutes. Set at 5 minutes.
6. A time delay in neutral shall provide a pause in a position connected to neither normal or emergency sources. Neutral time delay shall be in effect in either transfer direction. Time delay in neutral shall be adjustable 1-15 seconds. Set at 3 seconds.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged automatic transfer switch.
- B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before automatic transfer switch installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.02 WORKMANSHIP AND CONTRACTOR'S QUALIFICATIONS**

- A. Only quality workmanship will be accepted. Haphazard or poor installation practice will be cause for rejection of work.
- B. Provide foreman in charge of this work at all times.

#### **3.03 COORDINATION**

- A. Coordinate work with other trades to avoid conflict and to provide correct rough in and connection for equipment furnished under trades that require electrical connections. Inform Contractors of other trades of the required access to and clearances around electrical equipment to maintain serviceability and code compliance.
- B. Verify equipment dimensions and requirements with provisions specified under this section. Check actual job conditions before fabricating work. Report necessary changes in time to prevent needless work.

#### **3.04 INSTALLATION**

- A. Where the specifications call for an installation to be made in accordance with Manufacturer's recommendations, a copy of such recommendations shall at all times be kept in the job superintendent's office and shall be available to the Owner's Representative.
- B. Follow manufacturer's instructions where they cover points not specifically indicated on drawings and specifications obtain clarification from the Architect before starting work.
- C. Tighten electrical connectors and terminals; including screws and bolts, in accordance with equipment Manufacturers published torque-tightening values for equipment connectors. Where Manufacturers torque requirements are not indicated, tighten connectors and terminals to comply with tightening torque specified in NETA Standard Tables.
- D. Replace any panel pieces, doors or trims having dents, bends, warps or poor fit that may impede ready access, security or integrity.

**3.05 FIELD QUALITY CONTROL**

- A. Manufacturer's field service: Contractor shall arrange and pay for the services of a factory-authorized service representative to supervise the initial start-up, pretesting and adjustment of the transfer switch.
- B. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing, calibration and inspection required herein. Testing Agencies objectives shall be to:
  - 1. Assure transfer switch installation conforms to specified requirements and operates within specified tolerances.
  - 2. Field test and inspect to insure operation in accordance with Manufacturer's recommendations and Specifications.
  - 3. Prepare final test report including results, observations, failures, adjustments and remedies.
  - 4. Apply label on transfer switch upon satisfactory completion of tests and results.
  - 5. Verify ratings and settings and make final adjustments.
- C. Engineer witnessed testing: Allow a period of two hours per transfer switch for Engineer review and final check. This review shall be done when the transfer switch is de-energized, therefore plan accordingly. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.
- D. The Contractor shall supply a suitable and stable source of electrical power to each test site. The Testing Agency shall specify the specific power requirements.
  - 1. Interlocks and limit switch function.
  - 2. Time delay and retransfer upon normal power restoration.
  - 3. Engine cool-down and shutdown feature.
  - 4. Remote monitoring and indications.
- E. Functional performance testing: Upon completion of the work, at a time to be designated by the Owner, the Contractor shall demonstrate for the Owner the operation of the ATS, including any and all special items installed by him or installed under his supervision.
- F. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.
- G. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies and remedies. Test report shall be included in the operation and maintenance manuals.
- H. Failure to Meet Test:
  - 1. Any system material or workmanship which is found defective on the basis of acceptance tests shall be reported directly to the Owner.
  - 2. In the event that the system fails to function properly during the testing as a result of inadequate pretesting or preparation, the Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and the Engineer's hourly rate.
  - 3. Contractor shall replace the defective material or equipment and have test repeated until test proves satisfactory without additional cost to the Owner.

**3.06 CLEANING**

- A. Prior to energizing of transfer switch, the Contractor shall thoroughly clean the interior of enclosure of all construction debris, scrap wire, etc. using Manufacturer's approved methods and materials.

- B. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean both the interior and exterior of transfer switch per Manufacturer's approved methods and materials. Remove paint splatters and other spots, dirt and debris.
- C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

**3.07 TRAINING**

- A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner.

**END OF SECTION**

**SECTION 26 44 20  
PANELBOARDS****PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:
  - 1. Lighting and appliance branch-circuit panelboards.
  - 2. Distribution panelboards.

**1.03 DEFINITIONS**

- A. GFCI: Ground-fault circuit interrupter.

**1.04 SUBMITTALS**

- A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Enclosure types and details for types other than NEMA 250, Type 1.
    - b. Bus configuration, current, and voltage ratings.
    - c. Short-circuit current rating of panelboards and overcurrent protective devices.
    - d. UL listing for series rating of installed devices.
    - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- C. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.
- D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- E. Maintenance Data: For panelboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Contract Closeout," include the following:
  - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

**1.05 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.

**1.06 COORDINATION**

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
    - a. General Electric Co.; Electrical Distribution & Control Div.
    - b. Cutler Hammer
    - c. Siemens/Square D Co.
- B. Where existing surface mounted panels are relocated to new recessed locations, provide matching flush panel covers to match, if and as required for a proper installation.

### **2.02 FABRICATION AND FEATURES**

- A. Enclosures: mounted cabinets. NEMA PB 1, Type 1, to meet environmental conditions at installed location.
  - 1. Outdoor Locations: NEMA 250, Type 3R.
- B. Hinged Front Cover: Standard hinged door within trim cover.
- C. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
- D. Directory Card: With transparent protective cover, mounted inside metal frame, inside panel-board door.
- E. Bus: Hard-drawn copper or aluminum, 98 percent conductivity.
- F. Main and Neutral Lugs: type suitable for use with conductor material.
- G. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- H. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

### **2.03 PANELBOARD SHORT-CIRCUIT RATING**

- A. Fully rated to interrupt symmetrical short-circuit current available at terminals.
- B. AIC ratings shall be as noted on panel schedules. AIC calculation and date of calculation must be included with installation of main incoming service panel. Provide nameplate affixed to panel with this information.

### **2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS**

- A. Branch Overcurrent Protective Devices: Bolt-on or plug-in circuit breakers, replaceable without disturbing adjacent units.  
Doors: Front mounted with concealed hinges; secured with flush latch.

### **2.05 OVERCURRENT PROTECTIVE DEVICES**

- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  - 3. GFCI Circuit Breakers: Single- and two-pole configurations with 6-mA trip sensitivity.
- B. Molded-Case Circuit-Breaker Features and Accessories. Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and material of conductors.
2. Application Listing: Appropriate for application; Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 16 Section "Seismic Controls for Electrical Work."
- C. Mounting Heights: Top of trim 74 inches above finished floor, unless otherwise indicated.
- D. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable. All old circuit directories shall be completely replaced with new for all panels to be reused.
- E. Install filler plates in unused spaces.
- F. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.
- G. Provision for Future Circuits at Flush Panelboards: Stub two 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.

#### **3.02 IDENTIFICATION**

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section Electrical Identification.
- B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

#### **3.03 CONNECTIONS**

- A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

#### **3.04 FIELD QUALITY CONTROL**

- A. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
  1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers.
  2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- B. Balancing Loads: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:
  1. Measure as directed during period of normal system loading.
  2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data-processing, computing, transmitting, and receiving equipment.
  3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
  4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.



**3.05 CLEANING**

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

**END OF SECTION 26 44 20**

**SECTION 26 52 13**  
**EXIT SIGNS AND EMERGENCY LIGHTING**

**PART 1 GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

**1.02 SUMMARY**

- A. Section includes parking lot lighting mounted to poles.

**1.03 REFERENCE STANDARDS**

- A. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures
- B. National Electric Code, NFPA 70
- C. UL 924 – Standard for Safety of Emergency Lighting and Power Equipment

**1.04 COORDINATION**

- A. The electrical work shall be coordinated with the Work of other trades to prevent interferences and so that the progress in construction of the building will in no way be retarded.

**PART 2 PRODUCTS****2.01 CIRCUITS**

- A. Emergency lighting in stairways, exits and corridors shall be served by circuits entirely independent of other lighting. These circuits shall be supplied from panelboards and feeders separate from that for the general lighting system.

**2.02 BATTERY POWERED EMERGENCY LIGHTS WITH EXIT SIGNS**

- A. The circuits that provide normal power to battery powered emergency lights with exit signs shall be normally on, un-switched "night light" circuits that feed corridor, stairway and exit lights. These circuits shall be separate from all other lighting circuits in the building.
- B. Exit signs shall be illuminated with red or green light emitting diode (LED) type lamps. The LED lamps shall appear to form solid letters. Exit signs with the appearance of individual LED lamps are not permitted.
- C. Exit signs shall comply with UL 924. "Self-powered" or non-powered exit signs are not permitted.
- D. Units shall have a 3 year, 100 percent, no cost, complete unit exchange warranty.
- E. Individual emergency lighting units shall use sealed, pure lead, lead-calcium or nickel-cadmium batteries with a ten (10) year life expectancy.
- F. Units shall be capable of automatic 30 second exercise cycling on a 30 day basis, and automatic deep discharge cycling on a 12 month basis.
- G. Units shall have self-diagnostic feature with externally visible LED indicators to indicate trouble and malfunction. They shall not contain any audible alarms indicating trouble or malfunction.
- H. Units shall have an external switch or sensor to allow manual initiation of a 30 second and a 30 minute test of the battery and lamps.

**2.03 BATTERY POWERED EMERGENCY LIGHTS**

- A. The circuits that provide normal power to battery powered emergency lights shall be normally on, un-switched "night light" circuits that feed corridor, stairway and exit lights. These circuits shall be separate from all other lighting circuits in the building.

- B. Units shall have a 3 year, 100 percent, no cost, complete unit exchange warranty.
- C. Individual emergency lighting units shall use sealed, pure lead, lead-calcium or nickel-cadmium batteries with a ten (10) year life expectancy.
- D. Units shall be capable of automatic 30 second exercise cycling on a 30 day basis, and automatic deep discharge cycling on a 12 month basis.
- E. Units shall have self-diagnostic feature with externally visible LED indicators to indicate trouble and malfunction. They shall not contain any audible alarms indicating trouble or malfunction.
- F. Units shall have an external switch or sensor to allow manual initiation of a 30 second and a 30 minute test of the battery and lamps.
- G. Units installed at heights more than twelve feet above the floor, and units covered by a plastic guard, must be capable of being tested using a laser pointer.

**2.04 EXIT FIXTURES**

- A. Exit signs shall be illuminated with red or green light emitting diode (LED) type lamps. The LED lamps shall appear to form solid letters. Exit signs with the appearance of individual LED lamps are not permitted.
- B. Exit signs shall comply with UL 924. "Self-powered" or non-powered exit signs are not permitted.
- C. The requirements of section 2.3 above shall also apply to battery-powered exit signs.

**END OF SECTION**

**SECTION 26 56 00  
EXTERIOR LIGHTING**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

**1.02 SUMMARY**

- A. Section includes parking lot lighting mounted to poles.

**1.03 REFERENCE STANDARDS**

- A. Illumination Engineering Society of North America (IESNA) – Lighting Handbook
- B. American Association of State Highway and Transportation Officials (AASHTO) – Roadway Lighting Design Guide
- C. National Electric Code, NFPA 70

**1.04 COORDINATION**

- A. The electrical work shall be coordinated with the Work of other trades to prevent interferences and so that the progress in construction of the building will in no way be retarded.

**PART 2 PRODUCTS**

**2.01 PARKING LOTS**

- A. Poles shall be octagonal, direct embed concrete.
- B. Luminaires shall be arm or spider mounted round cylindrical cutoff fixture.
- C. Each pole shall be individually fused, with an in-line fuse located in the pole base.
- D. Provide a ground rod for all poles.

**2.02 LAMPS**

- A. Lamps shall be low mercury type and shall pass all federal TCLP (Toxicity Characteristic Leaching Procedure) test requirements at the time of manufacture.
- B. LED Lamps shall be field replaceable modules. Non-repairable fixtures shall not be used.

**2.03 BALLASTS AND DRIVERS**

- A. LED drivers shall be field replaceable and integrated with fixture housing for thermal management. Non-repairable fixtures shall not be used.

**2.04 RACEWAY AND CABLE**

- A. Under Paved Areas or Plants: Where cable is routed under paved streets, paved driveways, sidewalks, or areas with planting, a 2-inch PVC conduit shall be provided. This conduit shall have a bushing on each end and extend a minimum of 1 foot beyond the pavement or planting. This conduit shall be located a minimum of 24 inches below the concrete. If not, it shall be encased in concrete.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Fixture Location: Locations shown are approximate only. Install at locations shown on architectural drawings and as required to coordinate with tile patterns, architectural features, and Mechanical Work.

**3.02 OUTDOOR INSTALLATION**

- A. Install in accordance with manufacturers' instructions.
- B. Install lighting poles at locations indicated.
- C. Install poles plumb. Provide double nuts to adjust plumb. Grout around each base.
- D. Install lamps in each luminaire.
- E. Bond luminaires, metal accessories and metal poles to branch circuit equipment grounding conductor or provide supplementary grounding electrode at each pole as shown on the drawings.

**END OF SECTION**

**SECTION 28 46 00  
FIRE DETECTION AND ALARM**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

**1.02 SUMMARY**

- A. Furnish, install, test, certify, and place into service initiating and signaling devices for the fire alarm system. The system shall be complete with all hardware and software specifically tailored for this installation.
- B. Provide a fire alarm system consisting of, but not limited to the following components:
  - 1. Addressable manual fire alarm stations
  - 2. Addressable area smoke detectors
  - 3. Addressable duct smoke detectors
  - 4. Audible and visual combination notification appliances
- C. Provide a fire alarm system that conforms to the requirements of the latest editions of (1) NFPA 72 National Fire Alarm Code, (2) NFPA 70 National Electrical Code, (3) ASME A17.1 Safety Code for Elevators and Escalators, and (4) NFPA 90A Standard for the Installation of Air-Conditioning and Ventilating Systems.

**1.03 REFERENCES**

- A. ANSI/NFPA 70 - National Electrical Code.
- B. ANSI - American National Standards Institute.

**1.04 SUBMITTALS**

- A. Manufacturer's installation and maintenance instructions.
- B. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
- C. Complete bill of material listing all components.
- D. Warranty.

**1.05 QUALITY ASSURANCE**

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.
- C. Manufacturer qualifications: Firms regularly engaged in manufacture of fire alarm signaling and initiating devices, of types and sizes required and whose products have been in satisfactory use in similar service for not less than 5 years.
- D. Certification of installer training and contractor listing
  - 1. Within 30 days after Notice to Proceed, certifications of the qualifications of the fire alarm installing firm as described in the quality assurance paragraph of this Section.
  - 2. Within 30 days after Notice to Proceed, certifications of the qualifications of the fire alarm system technician as described in the quality assurance paragraph of this Section.
  - 3. Certification from the fire alarm control manufacturer that proposed alarm-initiating devices, alarm appliances, and auxiliary devices are compatible with the FAP and other auxiliary equipment.

4. "Record of Completion" and associated documentation for the completed system according to NFPA 72 prior to the system acceptance test.

**1.06 COORDINATION**

- A. The electrical work shall be coordinated with the Work of other trades to prevent interferences and so that the progress in construction of the building will in no way be retarded.

**1.07 WARRANTY**

- A. Units and components offered under this Section shall be covered by a one year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

**1.08 QUALITY ASSURANCE**

- A. Products shall be tested, approved and labeled/listed by Underwriters Laboratories, Inc., or by a nationally recognized testing laboratory (NRTL) as listed in Division 26 Specification "Common Work Results for Electrical."
- B. Equipment and materials shall be new and within one year of manufacture, complying with the latest codes and standards. No used, re-built, refurbished and/or re-manufactured electrical equipment and materials shall be furnished on this project.
- C. Installer Qualifications: A company licensed by State of New Hampshire as a fire alarm installer with a contractor's license, and specializing in installing the products specified in this specification with a minimum of three years documented experience.

**PART 2 PRODUCTS****2.01 MANUFACTURERS**

- A. Acceptable manufacturers of signaling and initiating devices include, but are not limited to:
  1. Honeywell-FCI
  2. Siemens
  3. Notifier
  4. Gamewell

**2.02 INITIATING DEVICES**

- A. Manual Station: Surface mounted, non-coded type, double action manual station.
- B. Ceiling Mounted Smoke Detector, photoelectric type, with adjustable sensitivity.
- C. Duct Mounted Smoke Detector: Photoelectric type detector, with common power supply and signal circuits.

**2.03 SIGNALING DEVICES**

- A. Provide NRTL-listed 24 VDC audio-visual combination-type electronic three-pulse temporal pattern sounder and strobe combination units that are acceptable to the FAP manufacturer and are compatible with the FAP.
- B. Strobe signal output and flash rate shall meet UL 1971 and ADAAG requirements. Unit shall have a xenon flash tube enclosed in a clear Lexan lens with "FIRE" in white lettering, and shall produce a synchronized strobe flash. Provide strobes with flash output levels as required to meet NFPA 72 visual signal requirements for each space.

**2.04 FIRE ALARM WIRE AND CABLE**

- A. All fire alarm wiring shall comply with the minimum size as required by the devices to be installed. Larger size wires shall be used for longer circuit runs to limit maximum voltage drop to 5 percent.

- B. Conductors: Provide alarm and supervisory signaling system conductors that meet the requirements of Article 760 in the NEC and are NRTL listed for the type of service to which they will be subjected. Minimum conductor requirements shall be as follows:
  - 1. Use red-jacketed NEC type FPL cable with No. 16 AWG (minimum) twisted-pair conductors for addressable devices; use shielded twisted-pair cables if required by the FAP manufacturer. Other low voltage conductors shall be type TFN, No. 16 AWG (minimum), thermoplastic insulation, and single solid copper conductor.
  - 2. Power conductors shall be type THHN/THWN, No. 12 AWG, thermoplastic insulation, and single solid copper conductor.
  - 3. Size conductors of the fire alarm systems as recommended by the manufacturer, based on the operating ampacity of the circuit and the permissible resistance and voltage drop characteristics that will allow proper operation of the equipment. Provide conductors selected to provide voltages within the manufacturer specification limits for the most remote fire alarm notification appliance or field device.
  - 4. Design each addressable analog loop so device loading will not exceed 80% of loop capacity in order to leave for space for future devices.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Prior to installation carefully inspect the installed work of other trades, whether pre-existing or part of this project and verify that such work is complete to the point where the installation of the fire alarm system may properly commence.
- B. Notify the Owner if conditions exist, not resulting from work of this project, that prohibit the installation from conforming to applicable codes, regulations, standards, and the original, approved design.

#### **3.02 DEVICE MOUNTING HEIGHTS**

- A. Install manual pull stations with center 44 inches above finished floor.
- B. Install combination audible/visual notification appliances with the bottom 84 inches above finished floor or 6 inches below ceiling, whichever is lower. In high bay type areas the devices may be installed at a maximum of 96 inches above the floor. Any deviations from these heights require approval from the City Representative.
- C. Comply with ADA Accessibility Guidelines (ADAAG) for device mounting heights and locations.

#### **3.03 WIRING INSTALLATION**

- A. Install fire alarm system wiring in conduit raceway.
- B. Do not pull wire or cable until the conduit system is complete between pull points.
- C. Run electronic cable continuous between termination points. No splicing is permitted without prior approval from the Owner. Where splicing is approved, use terminal strips that are acceptable to the Owner. Do not use "wire nuts."
- D. Circuit each addressable analog loop so device loading shall not exceed 80% of loop capacity in order to leave for space for future devices--the loop shall have Class B operation. Where it is necessary to interface conventional devices provide intelligent modules to supervise Class B wiring.
- E. All wiring shall be checked and tested to ensure that there are no grounds, opens, or shorts. The minimum allowable resistance between two conductors or between conductors and grounds is 10 mega-ohms, as checked with a 250V mega-ohm meter. This test shall be made after conduit, wire, etc. are installed, but before alarm initiators are plugged in.



**3.04 COORDINATION**

- A. Coordinate work with other trades to avoid conflict and to provide correct rough in and connection for equipment furnished under trades that require electrical connections. Inform Contractors of other trades of the required access to and clearances around electrical equipment to maintain serviceability and code compliance.
- B. Verify equipment dimensions and requirements with provisions specified under this section. Check actual job conditions before fabricating work. Report necessary changes in time to prevent needless work.

**3.05 INSTALLATION**

- A. Install all devices as indicated on the drawings. If alternative is required consult with Owner prior to installation.

**3.06 FIELD QUALITY CONTROL**

- A. Provide the services of a qualified factory trained and certified technician for the FAP installed on this project. The factory technician shall assure the completeness and correctness of the installation by performing the following:
  - 1. Prepare as-built documentation of FAP indicating location of components, interconnection of components, and connections to alarm initiating, indicating and auxiliary circuits.
  - 2. Field-verify and mark as-built drawings of fire alarm layout, conduit and wiring plans, and point-to-point field-wiring diagrams.
  - 3. Verify correct labeling of fire alarm system conductors.
  - 4. Verify that conductor sizes are adequate for each alarm initiating, indicating and auxiliary circuit.
  - 5. Measure and adjust audible alarm signal in all spaces to comply with ADAAG requirements: minimum 15 dBA above ambient, but not over 120 dBA at any location.
  - 6. Test all devices for proper supervision and alarm operation.
  - 7. Test all interlocks with HVAC and elevator system for proper operation in normal and by-pass modes.
  - 8. Perform pre-final acceptance inspections and tests of the fire alarm system modifications.
  - 9. Prepare final acceptance test plan.
- B. After the pre-final test, provide a report to the City representative indicating the status of the fire alarm system and any corrective actions required before the acceptance tests.
- C. Submit a detailed test plan for the final acceptance test.
- D. Submit the test plan not less than 10 working days before the planned final acceptance date.
- E. Follow test methods outlined in NFPA 72.
- F. Submit FAP program at least two weeks prior to final acceptance test.
- G. Submit final drawings, calculations, and manufacturer's data at least one week prior to final acceptance test.
- H. Coordinate date of final acceptance test with installer, City of Portsmouth representatives (Fire Protection Engineer and Fire Marshall), and sub-tier subcontractors for HVAC and sprinklers. Make corrective actions before final acceptance test date.

**3.07 CLEANING**

- A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean all areas associated with the installation.
- B. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

**END OF SECTION**

**SECTION 32 16 19**  
**CONCRETE CURBS, GUTTERS AND SIDEWALKS**

**PART 1 GENERAL**

**1.1 UNIT PRICES**

**A. Measurement**

**1. Sidewalks**

The quantities of sidewalks to be paid for will be the number of square yards of each depth of sidewalk as indicated on the drawings. Contractor shall verify all dimensions.

**2. Curbs and Gutters**

The quantities of curbs and gutters to be paid for will be the number of linear meters feet of each cross section as indicated on the drawings. Contractor shall verify all dimensions.

**B. Payment**

**1. Sidewalks**

Payment of the sidewalks shall be lump sum for the dimensions indicated on the drawings. No adjustments shall be made for as-constructed dimensions.

**2. Curbs and Gutters**

Payment of the curbs and gutters shall be lump sum based on the dimensions indicated on the drawings. No adjustments shall be made for as-constructed dimensions.

**1.2 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

**AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)**

AASHTO M 182	(2005; R 2017) Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats
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**ASTM INTERNATIONAL (ASTM)**

ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM A615/A615M	(2016) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C143/C143M	(2015) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C171	(2016) Standard Specification for Sheet Materials for Curing Concrete
ASTM C172/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2016) Standard Test Method for Air Content of

## Freshly Mixed Concrete by the Volumetric Method

ASTM C231/C231M	(2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C31/C31M	(2018) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C94/C94M	(2017a) Standard Specification for Ready-Mixed Concrete
ASTM D1751	(2004; E 2013; R 2013) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2004a; R 2013) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion
ASTM D5893/D5893M	(2016) Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

**INTERNATIONAL CODE COUNCIL (ICC)**

ICC A117.1 COMM	(2017) Standard And Commentary Accessible and Usable Buildings and Facilities
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**1.3 SUBMITTALS**

- A. Unless otherwise specified, submittals required in this section shall be submitted for review.  
Submittals shall be prepared and submitted in accordance with Division 1.
- B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.
- C. All submittals shall be reviewed and returned to the Architect within 10 working days.
- D. Incomplete submittals will not be reviewed.
- E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with.
- F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General

- Contractor shall compensate Engineer for additional review cycles.
- G. Hardcopy Submittals: Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.
- H. Electronic Submittals:
1. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.
  2. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.
  3. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Bluebeam version 12 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.
  4. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with. Electronic submittals without the Contractor's approval will be rejected and returned.
  5. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.
- I. Product Data: Submit producer's or manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
1. Reinforcement certified mill reports covering chemical and physical properties and yield strength.
  2. Patching products.
  3. Non-shrink grout.
  4. Curing compounds, where applicable.
  5. Admixtures.
  6. Expansion/Adhesive Anchors.
- J. Shop Drawings:
- 1 Shop Drawing Preparation: Electronic files of structural drawings will not be provided to the contractor for preparation of shop drawings. Reproduction of any portion of the Construction Documents for use as Shop drawings is prohibited. Shop drawings created from reproduced Construction Documents will be returned without review. Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with ACI 315, showing bar schedules, stirrup and tie spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required at openings through concrete elements. Include supplemental reinforcing and bar supports necessary to support reinforcing steel at proper location within forms or slabs.
  - 2 Review of the shop drawings will be made for the size and arrangement of reinforcement. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility.
  - 3 Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided all items listed prior. **Incomplete submittals will not be reviewed.**
- K. Mix designs: Submit all laboratory test reports and materials for each mix design listed within.

Prepare mixes by the field experience method and/or trial mixtures per the requirements of chapter 5 of ACI 318. Include the calculation of average strength and standard deviation. Proportioning by water cement ratio method will not be permitted.

- L. Samples: Submit samples of materials as specified and as otherwise requested by Architect, including names, sources and descriptions.
- M. Curing Methods: Submit documentation of curing methods to be used for review. Account for anticipated project temperature ranges and conditions in curing methods.
- N. Contraction/Construction Joints: Submit plan indicating proposed location of contraction and construction joints in walls and slabs.

Test Reports: Test reports shall be submitted to the Owner, Architect and Engineer within 48 hour after completion of each test.

#### **1.4 EQUIPMENT, TOOLS, AND MACHINES**

##### **A. General Requirements**

Plant, equipment, machines, and tools used in the work will be subject to approval and must be maintained in a satisfactory working condition at all times. Use equipment capable of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified.

Discontinue using equipment that produces unsatisfactory results. Allow the Contracting Officer access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

##### **O. Slip Form Equipment**

Slip form paver or curb forming machines, will be approved based on trial use on the job and must be self-propelled, automatically controlled, crawler mounted, and capable of spreading, consolidating, and shaping the plastic concrete to the desired cross section in one pass.

#### **1.5 ENVIRONMENTAL REQUIREMENTS**

##### **A. Placing During Cold Weather**

Do not place concrete when the air temperature reaches 40 degrees F and is falling, or is already below that point.

Placement may begin when the air temperature reaches 35 degrees F and is rising, or is already above 40 degrees F.

Make provisions to protect the concrete from freezing during the specified curing period. If necessary to place concrete when the temperature of the air, aggregates, or water is below 35 degrees F, placement and protection must be approved in writing.

Approval will be contingent upon full conformance with the following provisions. Prepare and protect the underlying material so that it is entirely free of frost when the concrete is deposited.

Heat [mixing water and aggregates] [mixing water] [aggregates] as necessary to result in the temperature of the in-place concrete being between 50 and 85 degrees F. Methods and equipment for heating must be approved. Use only aggregates that are free of ice, snow, and frozen lumps before entering the mixer. Provide covering or other means as needed to maintain the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

##### **B. Placing During Warm Weather**

The temperature of the concrete as placed must not exceed 85 degrees F except where an approved retarder is used. Cool the mixing water and aggregates as necessary to maintain a satisfactory placing temperature. The placing temperature must not exceed 95 degrees F at any time.

**PART 2 PRODUCTS****2.1 CONCRETE**

Provide concrete conforming to the applicable requirements of [Section 03 30 00.00 10 CAST-IN-PLACE CONCRETE] [ASTM C94/C94M] except as otherwise specified. Concrete must have a minimum compressive strength of 3500 psi at 28 days. Size of aggregate must not exceed 1-1/2 inches. Submit copies of certified delivery tickets for all concrete used in the construction.

**A. Air Content**

NOTE: The air content specified is for concrete that will be subjected to freezing weather and the possible action of deicing chemicals. In climates where freezing is not a factor but where air entrainment is used in local commercial practice to improve the workability and placeability of concrete, concrete having air content percent of 4.5 plus or minus 1.5 percent may be specified as Contractor's option to non air-entrained concrete.

Use concrete mixtures that have an air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer.

**B. Slump**

Use concrete with a slump of 3 inches plus or minus 1 inch for hand placed concrete or 1 inch plus or minus 1/2 inch for slipformed concrete as determined in accordance with ASTM C143/C143M.

**C. Reinforcement Steel**

NOTE: Reinforcement steel normally will not be required for curb and gutter construction. Where conditions exist that make it advantageous to use reinforcement steel, include the reinforcing steel details in the drawings, and include the following paragraphs in the Contract specification. Use reinforcement bars conforming to ASTM A615/A615M. Use wire mesh reinforcement conforming to ASTM A1064/A1064M.

**2.2 CONCRETE CURING MATERIALS****A. Impervious Sheet Materials**

Use impervious sheet materials conforming to ASTM C171, type optional, except that polyethylene film, if used, must be white opaque.

**B. Burlap**

Use burlap conforming to AASHTO M 182.

**C. White Pigmented Membrane-Forming Curing Compound**

Use white pigmented membrane-forming curing compound conforming to ASTM C309, Type 2.

**2.3 CONCRETE PROTECTION MATERIALS**

Use concrete protection materials consisting of a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the Contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

**2.4 JOINT FILLER STRIPS****A. Contraction Joint Filler for Curb and Gutter**

Use hard-pressed fiberboard contraction joint filler for curb and gutter.

**B. Expansion Joint Filler, Premolded**

NOTE: Either type of joint sealer may be specified if determined necessary by the Contracting Officer and the inapplicable publication removed. Joint sealing material may be omitted where sealing of expansion joints is not deemed essential or advisable. Unless otherwise indicated, use 1/2 inch thick premolded expansion joint filler conforming to ASTM D1751 or ASTM D1752.

## **2.5 JOINT SEALANTS**

Use cold-applied joint sealant conforming to ASTM C920 or ASTM D5893/D5893M.

## **2.6 FORM WORK**

Design and construct form work to ensure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Use wood or steel forms that are straight and of sufficient strength to resist springing during depositing and consolidating concrete.

### **A. Wood Forms**

Use forms that are surfaced plank, 2 inches nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Use forms with a nominal length of 10 feet. Radius bends may be formed with 3/4 inch boards, laminated to the required thickness.

### **B. Steel Forms**

Use channel-formed sections with a flat top surface and welded braces at each end and at not less than two intermediate points. Use forms with interlocking and self-aligning ends. Provide flexible forms for radius forming, corner forms, form spreaders, and fillers as needed. Use forms with a nominal length of 10 feet and that have a minimum of 3 welded stake pockets per form. Use stake pins consisting of solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

### **C. Sidewalk Forms**

Use sidewalk forms that are of a height equal to the full depth of the finished sidewalk.

### **D. Curb and Gutter Forms**

Use curb and gutter outside forms that have a height equal to the full depth of the curb or gutter. Use rigid forms for curb returns, except that benders or thin plank forms may be used for curb or curb returns with a radius of 10 feet or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 1-1/2 inch benders, for the full height of the curb, cleated together. In lieu of inside forms for curbs, a curb "mule" may be used for forming and finishing this surface, provided the results are approved.

### **E. Biodegradable Form Release Agent**

NOTE: Concrete release fluids are recognized as a biobased material. Use materials with biobased content where suitable for application and cost effective. Verify suitability, availability within the region, cost effectiveness, and adequate competition before specifying product biobased content requirements. A resource that can be used to identify products with bio-based content is the "Catalog" tab within the USDA's "Bio preferred" website at <https://www.biopreferred.gov/BioPreferred/>. Other products with biobased content are also acceptable when meeting all requirements of this specification. Use form release agent that is colorless and biodegradable and that is composed of at least 87 percent biobased material. Provide product that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces. Provide form release agent that does not



contain diesel fuel, petroleum-based lubricating oils, waxes, or kerosene.

## **2.7 Detectable Warning System**

Detectable Warning Systems shown on the Contract plans are to meet requirements of ICC A117.1 COMM - Section 705.

# **PART 3 EXECUTION**

## **3.1 SUBGRADE PREPARATION**

NOTE: On most projects, major grading operations involving excavation and construction of embankments will be performed and paid for under other sections of the specifications and, therefore, are not included in this guide specification. Where such work, including the construction of any required subbase, must be done under this section, paragraphs FORM SETTING, SIDEWALK CONCRETE PLACEMENT AND FINISHING, and CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING will be revised to cover necessary additional requirements. The subgrade will be indicated as extending at least 2 feet in width back of curb, gutter, entrance, and combination curb and gutters. Construct subgrade to the specified grade and cross section prior to concrete placement.

### **A. Sidewalk Subgrade**

Place and compact the subgrade in accordance with [Section 02 20 20 EARTHWORK] Test the subgrade for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

### **B. Curb and Gutter Subgrade**

Place and compact the subgrade in accordance with [Section 02 20 20 EARTHWORK] Test the subgrade for grade and cross section by means of a template extending the full width of the curb and gutter. Use subgrade materials equal in bearing quality to the subgrade under the adjacent pavement.

### **C. Maintenance of Subgrade**

Maintain subgrade in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade must be in a moist condition when concrete is placed. Prepare and protect subgrade so that it is free from frost when the concrete is deposited.

## **3.2 FORM SETTING**

Set forms to the indicated alignment, grade and dimensions. Hold forms rigidly in place by a minimum of 3 stakes per form placed at intervals not to exceed 4 feet. Use additional stakes and braces at corners, deep sections, and radius bends, as required. Use clamps, spreaders, and braces where required to ensure rigidity in the forms. Remove forms in a manner that will not injure the concrete. Do not use bars or heavy tools against the concrete when removing the forms. Promptly and satisfactorily repair concrete found to be defective after form removal. Clean forms and coat with form oil or biodegradable form release agent each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

### **A. Sidewalks**

Set forms for sidewalks with the upper edge true to line and grade with an allowable tolerance of 1/8 inch in any 10 foot long section. After forms are set, grade and alignment must be checked with a 10 foot straightedge. Sidewalks must have a transverse slope [as indicated] [of

1/4 inch per foot] [Unless otherwise indicated, construct sidewalks that are located adjacent to curbs with the low side adjacent to the curb. Do not remove side forms less than 12 hours after finishing has been completed.

B. Curbs and Gutters

Remove forms used along the front of the curb not less than 2 hours nor more than 6 hours after the concrete has been placed. Do not remove forms used along the back of curb until the face and top of the curb have been finished, as specified for concrete finishing. Do not remove gutter forms while the concrete is sufficiently plastic to slump in any direction.

### 3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

A. Formed Sidewalks

Place concrete in the forms in one layer. When consolidated and finished, the sidewalks must be of the thickness indicated. Use a strike-off guided by side forms after concrete has been placed in the forms to bring the surface to proper section to be compacted. Consolidate concrete by tamping and spading or with an approved vibrator. Finish the surface to grade with a strike off.

B. Concrete Finishing

After straight edging, when most of the water sheen has disappeared, and just before the concrete hardens, finish the surface with a wood or magnesium float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. Produce a scored surface by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.

C. Edge and Joint Finishing

Finish all slab edges, including those at formed joints, with an edger having a radius of 1/8 inch. Edge transverse joints before brooming. Eliminate the flat surface left by the surface face of the edger with brooming. Clean and solidly fill corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing with a properly proportioned mortar mixture and then finish.

D. Surface and Thickness Tolerances

Finished surface must not vary more than 5/16 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

### 3.4 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING

A. Formed Curb and Gutter

Place concrete to the required section in a single lift. Consolidate concrete using approved mechanical vibrators. Curve shaped gutters must be finished with a standard curb "mule".

B. Curb and Gutter Finishing

Approved slip formed curb and gutter machines may be used in lieu of hand placement.

C. Concrete Finishing

Float and finish exposed surfaces with a smooth wood float until true to grade and section and uniform in texture. Brush floated surfaces with a fine-hair brush using longitudinal strokes. Round the edges of the gutter and top of the curb with an edging tool to a radius of 1/2 inch. Immediately after removing the front curb form, rub the face of the curb with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. Brush the front curb surface, while still wet, in the same manner as the gutter and curb top. Finish the top surface of gutter [and entrance] to grade with a wood float.

D. Joint Finishing

Finish curb edges at formed joints as indicated.

E. Surface and Thickness Tolerances

Finished surfaces must not vary more than 6 mm 1/4 inch from the testing edge of a 3 m 10-foot straightedge. Permissible deficiency in section thickness will be up to 6 mm 1/4 inch.

### 3.5 SIDEWALK JOINTS

A. Sidewalk Contraction Joints

Form contraction joints in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness. Unless otherwise approved or indicated, either use a jointer to cut the groove or saw a groove in the hardened concrete with a power-driven saw. Construct sawed joints by sawing a groove in the concrete with a 1/8 inch blade. Provide an ample supply of saw blades on the jobsite before concrete placement is started. Provide at least one standby sawing unit in good working order at the jobsite at all times during the sawing operations.

B. Sidewalk Expansion Joints

Form expansion joints using 1/2 inch joint filler strips. Joint filler in expansion joints surrounding structures and features within the sidewalk may consist of preformed filler material conforming to ASTM D1752 or building paper. Hold joint filler in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, round joint edges using an edging tool having a radius of 1/8 inch. Remove any concrete over the joint filler. At the end of the curing period, clean the top of expansion joints and fill with cold-applied joint sealant. Use joint sealant that is gray or stone in color. Thoroughly clean the joint opening before the sealing material is placed. Do not spill sealing material on exposed surfaces of the concrete. Apply joint sealing material only when the concrete at the joint is surface dry and atmospheric and concrete temperatures are above 50 degrees F. Immediately remove any excess material on exposed surfaces of the concrete and clean the concrete surfaces.

C. Reinforcement Steel Placement

NOTE: Reinforcement steel normally will not be required for curb and gutter construction. Where conditions exist that make it advantageous to use reinforcement steel, the reinforcing steel details will be indicated, and the following paragraphs will be included in the Contract specification. Accurately and securely fasten reinforcement steel in place with suitable supports and ties before the concrete is placed.

### 3.6 CURB AND GUTTER JOINTS

Construct curb and gutter joints at right angles to the line of curb and gutter.

A. Contraction Joints

Construct contraction joints directly opposite contraction joints in abutting portland cement concrete pavements and spaced so that monolithic sections between curb returns will not be less than 5 feet nor greater than 15 feet in length.

1. Construct contraction joints (except for slip forming) by means of 1/8 inch thick separators and of a section conforming to the cross section of the curb and gutter. Remove separators as soon as practicable after concrete has set sufficiently to preserve the width and shape of the joint and prior to finishing.
2. When slip forming is used, cut the contraction joints in the top portion of the gutter/curb hardened concrete in a continuous cut across the curb and gutter, using a power-driven saw. Cut the contraction joint to a depth of at least one-fourth of the gutter/curb depth using a 1/8 inch saw blade.

**B. Expansion Joints**

Form expansion joints by means of preformed expansion joint filler material cut and shaped to the cross section of curb and gutter. Construct expansion joints in curb and gutter directly opposite expansion joints of abutting portland cement concrete pavement using the same type and thickness of joints as joints in the pavement. Where curb and gutter do not abut portland cement concrete pavement, provide expansion joints at least 1/2 inch in width at intervals not less than 30 feet nor greater than 120 feet. Seal expansion joints immediately following curing of the concrete or as soon thereafter as weather conditions permit. Seal expansion joints and the top 1 inch depth of curb and gutter contraction-joints with joint sealant. Thoroughly clean the joint opening before the sealing material is placed. Do not spill sealing material on exposed surfaces of the concrete. Concrete at the joint must be surface dry and atmospheric and concrete temperatures must be above 50 degrees F at the time of application of joint sealing material. Immediately remove excess material on exposed surfaces of the concrete and clean concrete surfaces.

**3.7 CURING AND PROTECTION****A. General Requirements**

Protect concrete against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Protect unhardened concrete from rain and flowing water. All equipment needed for adequate curing and protection of the concrete must be on hand and ready for use before actual concrete placement begins. Protect concrete as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

**B. Mat Method**

Cover the entire exposed surface with two or more layers of burlap. Overlap mats at least 6 inches. Thoroughly wet the mat with water prior to placing on concrete surface and keep the mat continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.

**C. Impervious Sheeting Method**

Wet the entire exposed surface with a fine spray of water and then cover with impervious sheeting material. Lay sheets directly on the concrete surface with the light-colored side up and overlapped 12 inches when a continuous sheet is not used. Use sheeting that is not less than 18-inches wider than the concrete surface to be cured. Secure sheeting using heavy wood planks or a bank of moist earth placed along edges and laps in the sheets. Satisfactorily repair or replace sheets that are torn or otherwise damaged during curing. Sheeting must remain on the concrete surface to be cured for not less than 7 days.

**D. Membrane Curing Method**

Apply a uniform coating of white-pigmented membrane-curing compound to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Coat formed surfaces immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Do not allow concrete surface to dry before application of the membrane. If drying has occurred, moisten the surface of the concrete with a fine spray of water and apply the curing compound as soon as the free water disappears. Apply curing compound in two coats by hand-operated pressure sprayers at a coverage of approximately 200 square feet/gallon for the total of both coats. Apply the second coat in a direction approximately at right angles to the direction of application of the first coat. The compound must form a uniform, continuous, coherent film that will not check, crack, or peel and must be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities

exist, apply an additional coat to the affected areas within 30 minutes. Respray concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied by the method and at the coverage specified above. Respray areas where the curing compound is damaged by subsequent construction operations within the curing period. Take precautions necessary to ensure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints. Tightly seal the top of the joint opening and the joint groove at exposed edges before the concrete in the region of the joint is resprayed with curing compound. Use a method used for sealing the joint groove that prevents loss of moisture from the joint during the entire specified curing period. Provide approved standby facilities for curing concrete pavement at a location accessible to the jobsite for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time. Adequately protect concrete surfaces to which membrane-curing compounds have been applied during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from other possible damage to the continuity of the membrane.

E. Backfilling

After curing, remove debris and backfill, grade, and compact the area adjoining the concrete to conform to the surrounding area in accordance with lines and grades indicated.

F. Protection

Protect completed concrete from damage until accepted. Repair damaged concrete and clean concrete discolored during construction. Remove and reconstruct concrete that is damaged for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Dispose of removed material as directed.

### 3.8 FIELD QUALITY CONTROL

Submit copies of all test reports within 24 hours of completion of the test.

A. General Requirements

Perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, take the action and submit reports as required below, and additional tests to ensure that the requirements of these specifications are met.

B. Concrete Testing

1. Strength Testing

Take concrete samples in accordance with ASTM C172/C172M not less than once a day nor less than once for every 250 cubic yards of concrete placed. Mold cylinders in accordance with ASTM C31/C31M for strength testing by an approved laboratory. Each strength test result must be the average of 2 test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 500 psi.

2. Air Content

Determine air content in accordance with ASTM C173/C173M or ASTM C231/C231M. Use ASTM C231/C231M with concretes and mortars made with relatively dense natural aggregates. Make two tests for air content on randomly selected batches of each class of concrete placed during each shift. Make additional tests when excessive variation in concrete workability is reported by the placing foreman or the Government inspector. Notify the

- placing foreman if results are out of tolerance. The placing foreman must take appropriate action to have the air content corrected at the plant. Additional tests for air content will be performed on each truckload of material until such time as the air content is within the tolerance specified.
3. Slump Test
- Perform two slump tests on randomly selected batches of each class of concrete for every 250 cubic yards, or fraction thereof, of concrete placed during each shift. Perform additional tests when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noted along the edges of slip-formed concrete.
- B. Thickness Evaluation
- Determine the anticipated thickness of the concrete prior to placement by passing a template through the formed section or by measuring the depth of opening of the extrusion template of the curb forming machine. If a slip form paver is used for sidewalk placement, construct the subgrade true to grade prior to concrete placement. The thickness will be determined by measuring each edge of the completed slab.
- C. Surface Evaluation
- Provide finished surfaces for each category of the completed work that are uniform in color and free of blemishes and form or tool marks.
- 3.9 SURFACE DEFICIENCIES AND CORRECTIONS**
- A. Thickness Deficiency
- When measurements indicate that the completed concrete section is deficient in thickness by more than 1/4 inch the deficient section will be removed, between regularly scheduled joints, and replaced.
- B. High Areas
- In areas not meeting surface smoothness and plan grade requirements, reduce high areas either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete must not exceed 5 percent of the area of any integral slab, and the depth of grinding must not exceed 1/4 inch. Remove and replace pavement areas requiring grade or surface smoothness corrections in excess of the limits specified.
- C. Appearance
- Exposed surfaces of the finished work will be inspected by the Contracting Officer and deficiencies in appearance will be identified. Remove and replace areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work.

**3.10 DETECTABLE WARNING SYSTEM**

Install Detectable Warning Systems required by Contract plans in accordance with ICC A117.1 COMM, Section 705, and by manufacturers' installation instructions.

**END OF SECTION**