

# **SALEM 1, 2 & 9 WARDS**

**Property # 505-0561-19010101**

## **SALEM UTAH WEST STAKE**

**Address:  
60 South Main Street  
Salem, Utah**

**DATE: 18 June 2020**

**MECHANICAL ENGINEER:  
DAVID L. JENSEN & ASSOCIATES  
547 West 500 South, Suite 140  
Bountiful, Utah 84010  
Phone: (801) 294-9299  
Fax: (801) 294-9399**



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# **BIDDING REQUIREMENTS**

**FOR SMALL PROJECTS (U.S.)**

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# INVITATION TO BID (U.S.)

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## 1. CONTRACTORS INVITED TO BID THE PROJECT:

BC Builders – [brett@bcbuildersinc.net](mailto:brett@bcbuildersinc.net)  
Dynamic Construction – [dynamiconstruction@gmail.com](mailto:dynamiconstruction@gmail.com)  
Gines Construction – [royce@ginesconstruction.net](mailto:royce@ginesconstruction.net)  
Majestic Builders – [contact@buildmajestic.com](mailto:contact@buildmajestic.com)  
Painter Building – [matt@painterbuilding.com](mailto:matt@painterbuilding.com)  
Oasis Builders – [danny@oasisbuilder.com](mailto:danny@oasisbuilder.com)  
SRFCO Inc. – [fris@srfco.com](mailto:fris@srfco.com)  
Stone River Construction – [stoneriver1234@msn.com](mailto:stoneriver1234@msn.com)  
Warner & Associates Construction – [joe@warnerconstructioninc.net](mailto:joe@warnerconstructioninc.net)

## 2. PROJECT:

Salem 1, 2 & 9 Wards  
Salem, UT West Stake  
Property No. 505-0561-19010101

## 3. LOCATION:

60 South Main Street  
Salem, Utah 84603

## 4. OWNER:

Corporation of the Presiding Bishop of  
The Church of Jesus Christ of Latter-day Saints, a Utah corporation sole  
c/o  
American Fork PM Office  
Milan Malkovich  
110 East Main Street  
American Fork, Utah 84003

## 5. CONSULTANT:

David L. Jensen and Associates, Inc.  
Hal Abercrombie  
547 West 500 South, Suite 140  
Bountiful, UT 84010

## 6. DESCRIPTION OF PROJECT:

- A. Replace twin furnace system with two separate furnace systems. Create new furnace room and extend tunnel.
- B. Products or systems may be provided under a Value Managed Relationship (VMR) the Owner has negotiated with the supplier. VMR products and systems are indicated as such in the Specifications.

7. **TYPE OF BID:** Bids will be on a lump-sum basis. Segregated bids will not be accepted.

8. **MANDATORY PREBID MEETING:** June 18<sup>th</sup> @ 10:00 AM, 60 South Main Street Salem, Utah 84603

9. **TIME OF SUBSTANTIAL COMPLETION:** The time limit for substantial completion of this work will be **120** calendar days and will be as noted in the Agreement.

10. **BID OPENING:** Sealed bids will be received on July 1, 2020 @ 2:00 PM. Bids will be publicly opened online using Conslog Software.

## 11. BIDDING DOCUMENTS:

- A. Bidding Documents are available to invited Contractors with a deposit of \$0 per set. Deposit will be refunded if documents are returned complete and in good condition within five days of bid opening.

**12. BIDDER'S QUALIFICATIONS:** Bidding by the Contractors will be by invitation only.

**13. OWNER'S RIGHT TO REJECT BIDS:** Owner reserves the right to reject any or all bids and to waive any irregularity therein.

END OF DOCUMENT

# INSTRUCTIONS TO BIDDERS (U.S.)

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## 1. DOCUMENTS:

- A. Bidding Documents include Bidding Requirements and proposed Contract Documents. Proposed Contract Documents consist of:
  - 1) Agreement Between Owner and Contractor for Small Project (U.S.)
  - 2) Other documents included by reference
  - 3) Addenda.
- B. Bidding Requirements are those documents identified as such in proposed Project Manual.
- C. Addenda are written or graphic documents issued prior to execution of the Contract which modify or interpret the Bidding Documents. They become part of the Contract Documents as noted in the Agreement Between Owner and Contractor for Small Project (U.S.) upon execution of the Agreement by Owner.

## 2. BIDDER'S REPRESENTATIONS:

- A. By submitting a bid proposal, bidder represents that
  - 1) Bidder has carefully studied and compared Bidding Documents with each other. Bidder understands the Bidding Documents and the bid is fully in accordance with the requirements of those documents,
  - 2) Bidder has thoroughly examined the site and any building located thereon, has become familiar with local conditions which might directly or indirectly affect contract work, and has correlated its personal observations with requirements of proposed Contract Documents, and
  - 3) Bid is based on materials, equipment, and systems required by Bidding Documents without exception.

## 3. BIDDING DOCUMENTS:

- A. Copies
  - 1) Owner will provide the Bidding Documents as set forth in the Invitation to Bid.
  - 2) Partial sets of Bidding Documents will not be issued.
- B. Interpretation or Correction of Bidding Documents
  - 1) Bidders will request interpretation or correction of any apparent errors, discrepancies, and omissions in the Bidding Documents.
  - 2) Corrections or changes to Bidding Documents will be made by written Addenda.
- C. Substitutions and Equal Products
  - 1) Equal products may be approved upon compliance with Contract Document requirements.
  - 2) Base bid only on materials, equipment, systems, suppliers or performance qualities specified in the Bidding documents.
  - 3) Where a specified product is identified as a "quality standard", products of other manufacturers that meet the performance, properties, and characteristics of the specified "quality standard" may be used without specific approval as a substitute.
- D. Addenda. Addenda will be sent to bidders and to locations where Bidding Documents are on file no later than one week prior to bid opening or by fax no later than 48 hours prior to bid

opening.

**4. BIDDING PROCEDURES:**

- A. Form and Style of Bids
  - 1) Use Owner's Bid Form.
  - 2) Bid will be complete and executed by authorized representative of Bidder.
  - 3) Do not delete from or add to the information requested on bid form.
  
- B. Submission of Bids
  - 1) Submit bid in sealed opaque envelope containing only bid form.
  - 2) It is bidder's sole responsibility to see that its bid is received at or before the specified time. Bids received after specified bid opening time may be returned to bidders unopened.
  - 3) No oral, facsimile transmitted, telegraphic, or telephonic bids, modifications, or cancellations will be considered.
  
- C. Modification or Withdrawal of Bid
  - 1) Bidder guarantees there will be no revisions or withdrawal of bid amount for 45 days after bid opening.
  - 2) Prior to bid opening, bidders may withdraw bid by written request or by reclaiming bid envelope.
  - 3) Prior to bid opening, bidder may mark and sign on the sealed envelope that bidder acknowledges any or all Addenda.

**5. CONSIDERATION OF BIDS:**

- A. Opening Of Bids - See Invitation to Bid.
  
- B. Acceptance Of Bid
  - 1) No bidder will consider itself under contract after opening and reading of bids until Owner accepts Contractor's Bid Proposal by executing same.
  - 2) Bidder's past performance, organization, subcontractor selection, equipment, and ability to perform and complete its contract in manner and within time specified, together with amount of bid, will be elements considered in award of contract.

**6. FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR:**

- A. Agreement form will be "Agreement Between Owner and Contractor for Small Project (U.S.)" provided by Owner.

**7. MISCELLANEOUS:**

- A. Pre-Bid Conference. A pre-bid conference may be held at a time and place to be announced.

END OF DOCUMENT

# INFORMATION AVAILABLE TO BIDDERS (U.S.)

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## 1. ASBESTOS-CONTAINING MATERIAL (ACM)

A. The building upon which work is being performed has been examined for asbestos-containing material. The following have been identified as containing asbestos in the areas of the building being worked on as part of this Project:

- 1) See asbestos report from FM group.

END OF DOCUMENT

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# BID FORM

FOR GENERAL CONTRACT WORK (U.S.)

**PROJECT IDENTIFICATION:**

Salem 1, 2 & 9 Wards  
Salem, UT West Stake  
Prop. No. 505-0561-19010101

**OWNER:**

The Church of Jesus Christ of Latter-day Saints, a Utah corporation sole ("Owner")

**CONSULTANT:**

David L. Jensen and Associates, Mechanical Engineers  
547 West 500 South, Suite 140  
Bountiful, Utah 84010

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**BID**

1. In submitting this Bid, Bidder represents that:
  - a. If this Bid is accepted, Bidder will enter into an agreement with Owner to perform and furnish the Work described in the Bidding Documents for the Bid Price and within the Time of Substantial Completion indicated in this Bid and in accordance with the other terms and conditions of the Contract Documents.
  - b. Bidder has carefully examined the Bidding Documents consisting of the Project Manual containing the Bidding Requirements, the Conditions of the Contract, the Specifications and the Drawings entitled Salem 1, 2 & 9 Wards, the Drawings entitled Salem 1, 2 & 9 Wards and dated May 21, 2020, and including sheets numbered G101, AD101, A101, A501, M001, M101, MD102, MH102, M401, M501, M502, M503, M601, ME101, EG101, EG500, ED102, EP102, EP700, EP800
  - c. Bidder has examined the site of the work, existing conditions, and all other conditions affecting the work on the above-named Project.
  - d. Bidder has carefully correlated the information known to Bidder and information and observations obtained from visits to the site with the Bidding Documents.
  - e. Bidder is familiar with federal, State, and local laws and regulations applicable to Project.
  - f. Bidder guarantees there will be no revisions or withdrawal of bid amount for forty-five (45) days after the bid opening.
2. Bidder hereby proposes to furnish all materials, labor, equipment, tools, transportations, services, licenses, fees, permits, etc., required by said documents to complete the Work described by the Contract Documents for the lump-sum of: \_\_\_\_\_ Dollars (\$ \_\_\_\_\_).
3. Bidder agrees to achieve substantial completion of the Work within the number of days indicated in the Invitation to Bid.

RESPECTFULLY SUBMITTED:

_____	Signature	
_____	Printed name	
_____	Title	
_____	Company name	
_____	Business Address	
_____	City, State, and Zip Code	
_____	Telephone	Fax
_____	Contact Email Address	

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**CONSTRUCTION MATERIAL ASBESTOS STATEMENT (U.S.)**

**PROJECTS FOR:  
CORPORATION OF THE PRESIDING BISHOP OF  
THE CHURCH OF JESUS CHRIST OF LATTER-DAY SAINTS**

Building Name: \_\_\_\_\_

Building Plan Type: \_\_\_\_\_

Building Address: \_\_\_\_\_

Building Owner: Corporation of the Presiding Bishop of The Church of Jesus Christ of Latter-day Saints, a Utah corporation sole.

Project Number: \_\_\_\_\_

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

As PROJECT CONSULTANT and principal in charge; based on my best knowledge, information, inspection, and belief; I certify that on the above referenced Project, no asbestos-containing building materials were specified in the construction documents or given approval in shop drawings or submittals.

\_\_\_\_\_  
Project Consultant and Principal in Charge (signature)                      Date

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

As GENERAL CONTRACTOR in charge of construction; based on my best knowledge, information, inspection, and belief; I affirm that on the above-referenced Project, no asbestos-containing building materials were used in the construction.

\_\_\_\_\_  
General Contractor (signature)                      Date

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

**SMALL PROJECT AGREEMENT  
BETWEEN OWNER AND CONTRACTOR  
Fixed Sum (U.S.)**

The Church of Jesus Christ of Latter-day Saints, a Utah corporation sole ("Owner") and \_\_\_\_\_ ("Contractor") enter into this *Small Project Agreement Between Owner and Contractor (U.S.)* ("Agreement") and agree as follows:

1. **Property/Project.**

Property/Project Number: \_\_\_\_\_  
Property Address ("Project Site"): \_\_\_\_\_  
Project Type: \_\_\_\_\_  
Project Name ("Project"): \_\_\_\_\_  
Stake Name: \_\_\_\_\_

2. **Scope of Work.** Contractor will furnish all labor, materials, tools, and equipment necessary to complete the Work in accordance with the Contract Documents. The Work is all labor, materials, tools, equipment, construction, and services required by the Contract Documents (the "Work").

3. **Contract Documents.** Contract Documents consist of:

- a. This Agreement;
- b. Supplementary Conditions for Small Project Agreement Between Owner and Contractor (U.S.);
- c. The Specifications (Division 01 and Divisions \_\_\_\_\_);
- d. Drawings entitled and dated \_\_\_\_\_;
- e. Addendum No. with date(s) \_\_\_\_\_;
- g. All written Field Changes, written Construction Change Directives and written Change Orders when prepared and signed by Owner and Contractor.

4. **Compensation.** Owner will pay Contractor for performance of Contractor's obligations under the Contract Documents the sum of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_) (the "Contract Sum"). This Contract Sum includes all labor, materials, equipment, tools, costs, expenses, work and services of Contractor and its subcontractors necessary to perform the Work in accordance with the terms of this Agreement, including without limitation travel, communications, and copying costs.

5. **Payment.**

- a. If the Contract Sum is over \$100,000 or if otherwise requested by Owner, Contractor will submit to Owner a schedule of values which allocates the Contractor's Bid Proposal Amount to various portions of the Work. This schedule, when accepted by Owner will be used as a basis for reviewing Contractor's payment requests.
- b. Not more than once each month, Contractor will submit a payment request to Owner. Owner will pay Contractor for work completed within thirty (30) days after Owner receives:
  - 1) Contractor's payment request for work to date;
  - 2) a certification by Contractor that Contractor has paid for all labor, materials, and equipment relating to the Work covered by prior payment requests and that Contractor will pay for all labor, materials, and equipment relating to the Work covered by the current payment request; and
  - 3) releases of all mechanics' liens and claims of subcontractors, laborers, or material suppliers who supplied labor and/or materials for the Work covered by the payment request.
  - 4) updated Construction Schedule.
- c. Owner may modify or reject the payment request if, in Owner's opinion, the Work for which payment is requested is not acceptable or is less complete than represented on the payment request.
- d. Contractor will timely pay subcontractors their portion of fees and expenses that Owner has paid to Contractor.

FORM OF AGREEMENT

6. **Extras and Change Orders.** Owner may order changes in the Work by altering, adding to, or deducting from the Work. In the event of such a change, the Contract Sum and/or the time of completion will be adjusted to reflect the change by means of a written Change Order signed by Contractor and Owner. Contractor will not commence work on any change until either: (a) Contractor and Owner have executed a Change Order; or (b) Owner has issued a written order for the change acknowledging that there is a dispute regarding the compensation adjustment relating to the change. If Contractor proceeds with a change in the Work without complying with the preceding sentence, Contractor agrees that it will not be entitled to any additional compensation for such change.
7. **Warranty and Correction of Work.** For all Work, services, labor, materials, products, and equipment provided under the Contract Documents, Contractor provides and extends to Owner all statutory, common law, and standard industry warranties as well as those warranties set forth in Owner's Contract Documents. Unless a longer period is specified by Owner's Contract Documents or otherwise, Contractor, at a minimum and in addition to all other warranties, warrants all Work under the Contract Documents for at least one year. Specifically, and without limitation, Contractor will promptly correct at its own expense:
- a. any portion of the Work which
    - 1) fails to conform to the requirements of the Contract Documents, or
    - 2) is rejected by the Owner as defective or because it is damaged or rendered unsuitable during installation or resulting from failure to exercise proper protection.
  - b. any defects due to faulty materials, equipment, or workmanship which appear within a period of one year from the date of completion of the Work or within such longer period of time as may be prescribed by law or the terms of any applicable special warranty required by the Contract Documents.
8. **Time of Completion.** Contractor will complete the Work and have it ready for Owner's inspection within \_\_\_\_\_ (\_\_\_\_\_) calendar days from Notice to Proceed issued by Owner. Time is of the essence. If Contractor is delayed at any time in the progress of the Work by any act or neglect of Owner, or by changes in the Work, or by strikes, lockouts, unusual delay in transportation, unavoidable casualties, or acts of nature beyond Contractor's control, then the time for completion will be extended by the time that completion of the Work is delayed. However, Contractor expressly waives any damages for any such delays.
9. **Owner Provided Items.** Owner may provide furnishings, equipment, and/or other items for the Project. Contractor will install items furnished by Owner and/or receive, store, and protect such items on site until the date Owner accepts the Project.
10. **Product Requirements.** Contractor will provide products that comply with Contract Documents, are undamaged, and, unless otherwise indicated, are new and unused at time of installation. Contractor will provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for complete installation and for intended use and effect.
11. **Permits, Surveys, and Taxes.** Contractor will obtain and pay for all permits and licenses, and also pay any applicable taxes. Contractor will also obtain and pay for any surveys it needs to perform the Work.
12. **Independent Contractor Relationship.** Contractor is not an agent or employee of Owner but is an independent contractor.
13. **Comply with Laws.** Contractor will comply, and ensure that all subcontractors comply, with all applicable laws, ordinances, rules, regulations, covenants, and restrictions.
14. **Indemnity and Hold Harmless.**
- a. Contractor will indemnify and hold harmless Owner and Owner's representatives, employees, agents, architects, and consultants from and against any and all claims, liens, damages, liability, demands, costs, judgments, awards, settlements, causes of action, losses and expenses (collectively "Claims" or "Claim"), including but not limited to attorney fees, consultant fees, expert fees, copy costs, and other expenses, arising out of or resulting from performance of or failure to perform the Work, attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of real or personal property, including loss of use resulting therefrom, except to the extent that such liability arises out of the negligence of Owner, its

representatives, agents, and employees. This indemnity includes, without limitation, indemnification of Owner from all losses or injury to Owner's property, except to the extent that such loss or injury arises out of the negligence of Owner, its representatives, agents, and employees. This indemnity applies, without limitation, to include Claims occurring both during performance of the Work and/or subsequent to completion of the Work. In the event that any Claim is caused in part by a party indemnified hereunder, that party will bear the cost of such Claim to the extent it was the cause thereof. In the event that a claimant asserts a Claim for recovery against any party indemnified hereunder, the party indemnified hereunder may tender the defense of such Claim to Contractor. If Contractor rejects such tender of defense and it is later determined that the negligence of the party indemnified hereunder did not cause all of the Claim, Contractor will reimburse the party indemnified hereunder for all costs and expenses incurred by that party in defending against the Claim. Contractor will not be liable hereunder to indemnify any party for damages resulting from the sole negligence of that party.

- b. In addition to the foregoing, Contractor will be liable to defend Owner in any lawsuit filed by any Subcontractor relating to the Project. Where liens have been filed against Owner's property, Contractor (and/or its bonding company which has issued bonds for the Project) will obtain lien releases and record them in the appropriate county and/or local jurisdiction and provide Owner with a title free and clear from any liens of Subcontractors. In the event that Contractor and/or its bonding company are unable to obtain a lien release, Owner in its absolute discretion may require Contractor to provide a bond around the lien or a bond to discharge the lien, at Contractor's sole expense.
- c. In addition to the foregoing, Contractor will indemnify and hold Owner harmless from any claim of any other contractor resulting from the performance, nonperformance or delay in performance of the Work by Contractor.
- d. The indemnification obligation herein will not be limited by a limitation on the amount or type of damages, compensation or benefits payable by or for Contractor or a Subcontractor under workers compensation acts, disability benefit acts, or other employee benefit acts.

15. **Work Restrictions.** Contractor will ensure that Contractor, its agents, employees, and subcontractors:

- a. Do not use or consume alcohol, or cannabis, or illegally use drugs, on the Project Site or enter on or perform any Work on the Project Site while under their influence.
- b. Do not smoke or vape anything on the Project Site. Do not use tobacco in any form on the Project Site.
- c. Do not perform Work on the Project Site on Sundays except for emergency work.
- d. Refrain from using profanity or being discourteous or uncivil to others on the Project Site or while performing Work under this Agreement.
- e. Do not view or allow pornographic or other indecent materials on the Project Site.
- f. Do not play obnoxious and/or loud music on the Project Site. Do not play any music within existing facilities.
- g. Refrain from wearing immodest, offensive, or obnoxious clothing, while on the Project Site.
- h. Do not bring weapons on the Project Site.

16. **Safety Hazards.** Contractor will ensure that no work or services will be performed that may pose an undue safety hazard to Contractor, Contractor's employees, or any other person.

17. **Contractor's Insurance.** Prior to performing any work, Contractor will obtain and maintain during the term of this Agreement the following insurance:

- a. Workers Compensation Insurance or evidence of exemption.
- b. Employers Liability Insurance with minimum limits of the greater of \$500,000 E.L. each accident, \$500,000 E. L. disease-each employee, \$500,000 E.L. disease-policy limit or as required by the law of the state in which the Project is located.
- c. Commercial General Liability Insurance – ISO Form CG 00 01 (12/07) or equivalent Occurrence policy which will provide primary coverage to the additional insureds (the Owner and the Architect) in the event of any Occurrence, Claim, or Suit with:
  - 1) Limits of the greater of: Contractor's actual coverage amounts or the following:
    - a) \$2,000,000 General Aggregate;
    - b) \$2,000,000 Products - Comp/Ops Aggregate;
    - c) \$1,000,000 Personal and Advertising Liability;
    - d) \$1,000,000 Each Occurrence; and

- e) \$50,000 Fire Damage to Rented Premises (Each Occurrence)
- 2) Endorsements attached to the General Liability policy including the following or their equivalent:
  - a) ISO Form CG-25-03 (05/09), Amendment of Limits of Insurance (Designated Project or Premises) describing the Agreement and specifying limits as shown above.
  - b) ISO Form CG 20 10 (07/04), Additional Insured – Owners, Lessees, Or Contractors (Form B), naming Owner and Architect as additional insureds.
- d. Automobile Liability Insurance, with:
  - 1) Combined Single Limit each accident in the amount of no less than \$500,000; and
  - 2) Coverage applying to "Any Auto" or its equivalent.

Contractor will provide evidence of these insurance coverages to Owner by providing an ACORD 25 (2010/05) Form or its equivalent: (1) listing Owner as the Certificate Holder and Additional Insured on the general liability and any excess liability policies, (2) listing the insurance companies providing coverage (all companies listed must be rated in A.M. Best Company Key Rating Guide-Property-Casualty and each company must have a rating of B+ Class VII or higher), (3) attaching the endorsements set forth above for the Certificate of Liability Insurance, and (4) bearing the name, address and telephone number of the producer and signed by an authorized representative of the producer. (The signature may be original, stamped, or electronic.) Notwithstanding the foregoing, Owner may, in writing and at its sole discretion, modify these insurance requirements.

18. **Resolution of Disputes.** In the event there is any dispute arising under the Contract Documents which cannot be resolved by agreement between the parties, either party may submit the dispute with all documentation upon which it relies to Director of Architecture, Engineering, and Construction, 50 East North Temple, Salt Lake City, Utah 84150, who will convene a dispute resolution conference within thirty (30) days. The dispute resolution conference will constitute settlement negotiations and any settlement proposal made pursuant to the conference will not be admissible as evidence of liability. In the event that the parties do not resolve their dispute pursuant to the dispute resolution conference, either party may commence legal action to resolve the dispute. Any such action must be commenced within six (6) months from the first day of the dispute resolution conference or be time barred. Submission of the dispute to the Director as outlined above is a condition precedent to the right to commence legal action to resolve any dispute. In the event that either party commences legal action to adjudicate any dispute without first submitting the dispute to the Director, the other party will be entitled to obtain an order dismissing the litigation without prejudice and awarding such other party any costs and attorney fees incurred by that party in obtaining the dismissal, including without limitation copy costs, and expert and consultant fees and expenses. Pending final resolution of a dispute hereunder, Contractor will proceed diligently with the performance of its obligations pursuant to this Agreement.
19. **Termination by Contractor.** In the event Owner materially breaches any term of the Contract Documents, Contractor will promptly give Written Notice of the breach to Owner. If Owner fails to cure the breach within ten (10) days of the Written Notice, Contractor may terminate this Agreement by giving Written Notice to Owner and recover from Owner the percentage of the Contract Sum represented by the Work completed on the Project site as of the date of termination together with any out of pocket loss Contractor has sustained with respect to materials and equipment as a result of the termination prior to completion of the Work, less any offsets. Contractor will not be entitled to unearned profits or any other compensation or damages as a result of the termination and hereby waives any claim therefor. Contractor will provide to Owner all warranty, as built, inspection, and other close out documents as well as materials that Contractor has in its possession or control at the time of termination. Without limitation, Contractor's indemnities and obligations as well as all warranties relative to Work provided through the date of termination survive a termination hereunder.
20. **Termination by Owner for Cause.** Should Contractor fail to timely provide Owner with the certificates of insurance, make a general assignment for the benefit of its creditors, fail to apply enough properly skilled workmen or specified materials to properly prosecute the Work in accordance with Contractor's schedule, or otherwise materially breach any provision of the Contract Documents, then Owner may, without any prejudice to any other right or remedy, give Contractor Written Notice thereof. If Contractor fails to cure its default within ten (10) days, Owner may terminate this Agreement by giving Written Notice to Contractor. In such case, Owner may, in Owner's sole discretion, take legal assignment of subcontracts and other contractual

rights of Contractor and/or take possession of the premises and all materials, tools, equipment, and appliances thereon, and finish the Work by whatever method Owner deems expedient. Contractor will not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Sum exceeds the expense of finishing the Work, including compensation for additional administrative, architectural, consultant, and legal services (including without limitation attorney fees, expert fees, copy costs, and other expenses), such excess will be paid to Contractor, less any offsets. If such expense exceeds the unpaid balance, Contractor will pay the difference to Owner. Contractor will provide to Owner all warranty, as built, inspection, and other close out documents as well as materials that Contractor has in its possession or control at the time of termination. Without limitation, Contractor's indemnities and obligations as well as all warranties relative to Work provided through the date of termination survive a termination hereunder.

21. **Termination by Owner for Convenience.** Notwithstanding any other provision contained in the Contract Documents, Owner may, without cause and in its absolute discretion, terminate this Agreement at any time. In the event of such termination, Contractor will be entitled to recover from Owner the percentage of the Contract Sum equal to the percentage of the Work which Owner and/or its architect determines has been completed on the Project site as of the date of termination together with any out of pocket loss Contractor has sustained with respect to materials and equipment as a result of the termination prior to completion of the Work, less any offsets. Contractor will not be entitled to unearned profits or any other compensation as a result of the termination and hereby waives any claim therefor. Contractor will provide to Owner all warranty, as built, inspection, and other close out documents as well as materials that Contractor has in its possession or control at the time of termination. Owner may, in Owner's sole discretion, take legal assignment of subcontracts and other contractual rights of Contractor. Without limitation, Contractor's indemnities and obligations as well as all warranties relative to Work provided through the date of termination survive a termination hereunder.
22. **Enforcement.** In the event either party commences legal action to enforce or rescind any term of this Agreement, the prevailing party will be entitled to recover its attorney fees, costs and legal expenses, including without limitation all copy costs and expert and consultant fees and expenses, incurred in that action and on all appeals, from the other party.
23. **Ownership of Materials, Products, and Intellectual Property Rights.** Owner will retain ownership and intellectual property rights in all plans, designs, drawings, documents, concepts, and materials provided by or on behalf of Owner to Contractor and to all work products of Contractor and its subcontractors for products, services, and Work provided under this Agreement, such products, services, and Work of Contractor and its subcontractors constituting works made for hire. Neither Contractor nor its subcontractors will reuse any portion of such items provided by Owner or work products developed by Contractor or its subcontractors for Owner pursuant to this Agreement or disclose any such items to any third party without the prior written consent of Owner. Owner may withhold its consent in its absolute discretion. Contractor shall obtain the written agreement of each of its subcontractors to the terms of this section prior to permitting the subcontractor to perform any services contemplated by this Agreement.
24. **Comply with Intellectual Property Rights of Others.** Contractor represents and warrants that no Work or services (with its means, methods, goods, and services attendant thereto), provided to Owner will infringe or violate any right of any third party and that Owner may use and exploit such Work, means, methods, goods, and services without liability or obligation to any person or entity (specifically and without limitation, such Work, means, methods, goods, and services will not violate rights under any patent, copyright, trademark, or other intellectual property right or application for the same).
25. **Ownership and Use of Renderings and Photographs.** Renderings, photographs, and/or other images of or representing the services, Work, or any improvement on or relative to the Project Site, whether created before, during, or at completion of construction (and whether created by Owner, Contractor, or Contractor's subcontractors), are the property of the Owner. Contractor hereby transfers and assigns to Owner all ownership and intellectual property rights that Contractor and/or its subcontractors may have in and to all such renderings, photographs, and other images. The Owner reserves all rights including copyrights and other intellectual property rights to such renderings, photographs, and other images. No such renderings, photographs, or other images shall be used or distributed without written consent of the Owner.

26. **Public Statements.** Contractor will not make any statements or provide any information to the media about the Project or Work without the prior written consent of Owner. If Contractor receives any requests for information from media, Contractor will refer such requests to Owner.
27. **Confidentiality.** Contractor shall ensure that Contractor and its subcontractors, and the employees, agents and representatives of Contractor and its subcontractors, maintain in strict confidence, and shall use and disclose only as authorized by Owner all Confidential Information of Owner that Contractor receives in connection with the performance of this Agreement. Notwithstanding the foregoing, Contractor may use and disclose any information to the extent required by an order of any court or governmental authority, but only after it has notified Owner and Owner has had an opportunity to obtain reasonable protection for such information in connection with such disclosure. For purposes of this Agreement, "Confidential Information" means:
- The name or address of any affiliate, customer or contractor of Owner or any information concerning the transactions of any such person with Owner;
  - Any contracts, agreements, business plans, budgets or other financial information, renderings, photographs, and materials provided by Owner, relating to the Work or any improvement on the Project Site to the extent such has not been made available to the public by the Owner;
  - Any other information that is marked or noted as confidential at the time of its disclosure.
28. **No Commercial Use of Transaction or Relationship.** Without the prior written consent of Owner, which Owner may grant or withhold in its sole discretion, neither Contractor nor Contractor's affiliates, officers, directors, agents, representatives, shareholders, members, subcontractors, or employees shall make any private commercial use of their relationship to Owner or the Project, including, without limitation:
- By referring to the Owner or Project verbally or in any sales, marketing or other literature, letters, client lists, press releases, brochures or other written materials except as may be necessary for Contractor to perform Contractor's obligations under the terms of this Agreement;
  - By using or allowing the use of any photographs of the Work or Project or any part thereof, or of any service mark, trademarks or trade names or other intellectual property now or which may hereafter be associated with, owned by or licensed by Owner, in connection with any work, service or product; or
  - By contracting with or receiving money or anything of value from any person or commercial entity to facilitate such person or entity obtaining any type of commercial identification, advertising or visibility in connection with the Owner or Project.
- Notwithstanding the foregoing, Contractor may include a reference to Owner or the Project in a professional résumé or other similar listing of Contractor's references without seeking Owner's written consent in each instance, provided that such reference to Owner or the Project is included with at least several other similar references to projects of different owners and is given no more prominence than such other references.
29. **Entire Agreement.** This Agreement contains the entire and integrated agreement between the parties hereto and supersedes all prior negotiations, representations, or agreements, either written or oral, relating to the Project. This Agreement may be amended only by a writing signed by both parties. This Agreement will not be construed to create a contractual relationship of any kind between any persons or entities other than Owner and Contractor.
30. **Assignment.** Contractor will not assign any right or obligation hereunder without the prior written consent of the Owner, which consent may be granted or withheld in Owner's absolute discretion.
31. **Governing Law.** The parties acknowledge that the Contract Documents have substantial connections to the State of Utah. The Contract Documents will be deemed to have been made, executed, and delivered in Salt Lake City, Utah. To the maximum extent permitted by law, (i) the Contract Documents and all matters related to their creation and performance will be governed by and enforced in accordance with the laws of the State of Utah, excluding conflicts of law rules, and (ii) all disputes arising from or related to the Contract Documents will be decided only in a state or federal court located in Salt Lake City, Utah and not in any other court or state. Toward that end, the parties hereby consent to the jurisdiction of the state and federal courts located in Salt Lake City, Utah and waive any other *venue* to which they might be entitled by virtue of domicile, habitual residence, place of business, or otherwise.

32. **Effective Date.** The effective date of this Agreement is the date indicated by Owner's signature.

**OWNER:**

The Church of Jesus Christ of Latter-day Saints,  
a Utah corporation sole

**CONTRACTOR:**

Signature:

Signature:

Print Name:

Print Name:

Title:

Title:

Address:

Address:

Telephone No:

Telephone No:

Facsimile No:

Facsimile No:

Email:

Email:

Effective Date:

Fed. I.D. or SSN:

Reviewed By:

License No:  
Date Signed:

**FORM OF AGREEMENT**



# SUPPLEMENTARY CONDITIONS

## FOR CONTRACTOR BID PROPOSAL AND PROJECT AGREEMENT (U.S.)

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### **ITEM 1 - GENERAL**

1. Conditions of the Contract apply to each Division of the Specifications.
2. Provisions contained in Division 01 apply to all Divisions of the Specifications.

### **ITEM 2 - LIQUIDATED DAMAGES PAYABLE TO OWNER**

**Delay in Completion of the Work.** For each day after the expiration of the designated Time of Completion that Contractor has not completed the Work, Contractor will pay Owner the amount of One hundred dollars (\$100.00) per day as liquidated damages for Owner's loss of use and the added administrative expense to Owner to administer the Project during the period of delay. In addition, Contractor will reimburse Owner for any additional Architect's fees, attorneys' fees, expert fees, consultant fees, copy costs, and other expenses incurred by Owner as a result of the delay. Owner may deduct any liquidated damages or reimbursable expenses from any money due or to become due to Contractor. If the amount of liquidated damages and reimbursable expenses exceeds any amounts due to Contractor, Contractor will pay the difference to Owner within ten (10) days after receipt of a written request from Owner for payment.

### **ITEM 3 - STATE SPECIFIC SUPPLEMENTARY CONDITIONS**

#### **UTAH STATE SALES TAX:**

*Add the following to the Bid Proposal and Project Agreement:*

1. Contractors should be exempt on purchases of material installed or converted into real property to be used by the Owner. The Contractor will furnish each vendor with a completed Exemption Certificate Form TC-721. The certificate will be prepared by the Contractor for each vendor in order to obtain the exemption.
2. The Owner's tax exempt number is 11871701-002-STC.

#### **UTAH NOTICE OF INTENT TO OBTAIN FINAL COMPLETION:**

*Add the following to the Bid Proposal and Project Agreement:*

- A. Contractor shall file with the State Construction Registry, on its own behalf and/or on behalf of Owner, a notice of intent to obtain final completion at least 45 days before the day on which the Owner or Contractor files or could file a notice of completion under Utah Code Ann. Section 38-1a-506 if:
  1. The completion of performance time under the original contract for construction work is greater than 120 days;
  2. The total original construction contract price exceeds \$500,000; and
  3. The original contractor or owner has not obtained a payment bond in accordance with Utah Code Ann. Section 14-2-1.

#### **UTAH NOTICE OF COMPLETION:**

*Add the following to the Bid Proposal and Project Agreement:*

- A. Within five (5) calendar days of final completion of the Project and in compliance with Section 38-1a-507 Utah Code Annotated, Contractor shall file with the State Construction Registry, and copy to Owner, a notice of completion which shall include, without limitation, the following:

1. The name, address, telephone number, and email address of the person filing the notice of completion;
  2. The name of the county in which the Project and/or Project site is located;
  3. The date on which final completion is alleged to have occurred;
  4. The method used to determine final completion; and
  5. One of the following:
    - a. The tax parcel identification number of each parcel included in the Project and/or Project site;
    - b. The entry number of a preliminary notice on the same project that includes the tax parcel identification number of each parcel included in the Project and/or Project site; or
    - c. The entry number of the building permit issued for the Project.
- B. Notwithstanding any other provision of the Contract Documents to the contrary, Contractor and Owner agree that any breach or failure to comply with this Section by the Contractor will constitute a breach of contract and the Contractor will be liable for any direct, indirect, or consequential damages to the Owner flowing from this breach.

**UTAH STATE PROGRESS PAYMENTS AND FINAL PAYMENT:**

*Replace paragraph 5 of the Bid Proposal and Project Agreement with the following:*

**5. Payment**

- a. If the Contractor's Bid Proposal Amount is over \$100,000.00, Contractor will submit to Owner a schedule of values which allocates the Contractor's Bid Proposal Amount to various portions of the Work. This schedule, when accepted by Owner, will be used as a basis for reviewing Contractor's payment requests.
- b. Progress Payments: Not more than once each month, Contractor will submit a payment request to Owner. Owner will pay Contractor progress payments for work completed within fifteen (15) days after Owner receives:
  1. Contractor's progress payment request for work to date;
  2. A certification by Contractor that Contractor has paid for all labor, materials, and equipment relating to the Work covered by prior payment requests and that Contractor will pay for all labor, materials, and equipment relating to the Work covered by the current payment request; and
  3. Conditional Waiver and Release Upon Progress Payment documents submitted by Contractor (in content complying with Utah Code § 38-1a-802) executed by each of the subcontractors performing work and/or providing materials covered by the Contractor's progress payment request.
- c. Final Payment: Owner will make full and final payment of the Contract Sum due within thirty (30) days of the completion of all of the following requirements:
  1. Contractor has submitted its final payment request;
  2. Contractor has submitted a certification that Contractor has paid for all labor, materials, and equipment relating to the Work covered by prior payment requests and that Contractor will pay for all labor, materials, and equipment relating to the Work covered by the final payment request; and
  3. Contractor has submitted Waiver and Release Upon Final Payment documents (in content complying with Utah Code § 38-1a-802) executed by each of the subcontractors performing work and/or providing materials covered by the Contractor's final payment request.

Acceptance of final payment by Contractor or any Subcontractor will constitute a waiver of claims by the payee except for those claims previously made to Owner in writing and identified by Contractor in its affidavit as still pending.  
If the aggregate of previous payments made by Owner exceeds the amount due Contractor, Contractor will reimburse the difference to Owner.
- d. Owner may modify or reject any payment request if, in Owner's opinion, the Work for which payment is requested is not acceptable or is less complete than represented on the payment request.
- e. Upon receipt of any payment from Owner, Contractor will pay to each Subcontractor the amount

paid to Contractor on account of such Subcontractor's portion of the Work.

- f. Contractor will maintain a copy of each payment request at the Project site for review by the Subcontractors.
- g. No payment made, either in whole or in part, by Owner will be construed to be an acceptance of defective or improper materials or workmanship.

END OF DOCUMENT

**DIVISION 01: GENERAL REQUIREMENTS****01 1000 SUMMARY**

01 1100	SUMMARY OF WORK
01 1200	MULTIPLE CONTRACT SUMMARY
01 1400	WORK RESTRICTIONS

**01 2000 PRICE AND PAYMENT PROCEDURES**

01 2900	PAYMENT PROCEDURES
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**01 3000 ADMINISTRATIVE REQUIREMENTS**

01 3100	PROJECT MANAGEMENT AND COORDINATION
01 3200	CONSTRUCTION PROGRESS DOCUMENTATION
01 3300	SUBMITTAL PROCEDURES
01 3500	SPECIAL PROCEDURES

**01 4000 QUALITY REQUIREMENTS**

01 4000	QUALITY REQUIREMENTS
01 4200	REFERENCES
01 4301	QUALITY ASSURANCE – QUALIFICATIONS
01 4523	TESTING AND INSPECTING SERVICES
01 4546	DUCT TESTING, ADJUSTING AND BALANCING

**01 5000 TEMPORARY FACILITIES AND CONTROLS**

01 5600	TEMPORARY BARRIERS AND ENCLOSURES
01 5700	TEMPORARY CONTROLS

**01 6000 PRODUCT REQUIREMENTS**

01 6100	COMMON PRODUCT REQUIREMENTS
01 6200	PRODUCT OPTIONS
01 6600	PRODUCT DELIVERY, STORAGE AND HANDLING REQUIREMENTS

**01 7000 EXECUTION AND CLOSEOUT REQUIREMENTS**

01 7100	EXAMINATION AND PREPARATION
01 7300	EXECUTION
01 7400	CLEANING AND WASTE MANAGEMENT
01 7700	CLOSEOUT PROCEDURES
01 7800	CLOSEOUT SUBMITTALS

**END OF TABLE OF CONTENTS**

**SECTION 01 1100**

**SUMMARY OF WORK**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes But is Not Limited To:
  - 1. Administrative and procedural requirements Summary of Work requirements.

**1.2 WORK COVERED BY CONTRACT DOCUMENTS**

- A. Provisions contained in Division 01 apply to Sections of Divisions 02 through 49 of Specifications. Instructions contained in Specifications are directed to Contractor. Unless specifically provided otherwise, obligations set forth in Contract Documents are obligations of Contractor.
- B. Contractor shall furnish total labor, materials, equipment, and services necessary to perform The Work in accordance with Contract Documents.

**1.3 WORK BY OWNER**

- A. Owner will furnish and install some portions of The Work with its own forces. Contractor will be provided with schedule of when these items are to be performed.
  - 1. General:
    - a. Complete work necessary to accommodate work to be performed by Owner before scheduled date for performance of such work. Contractor will be back charged for actual expenses incurred by Owner for failure to timely complete such work.
    - b. Store and protect completed work provided by Owner until date of Substantial Completion.
  - 2. Work furnished and installed by Owner include, but are not limited to, following:
    - a. HVAC test and balance

**PART 2 - PRODUCTS Not Used**

**PART 3 - EXECUTION Not Used**

**END OF SECTION**

**SECTION 01 1200****MULTIPLE CONTRACT SUMMARY****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes But is Not Limited To:
1. Administrative and procedural requirements for Multiple Contracts.

**1.2 SUMMARY OF CONTRACTS**

- A. Owner may issue separate contracts for operations scheduled to precede and be substantially completed before beginning of The Work under this Contract.
1. Contractor will be given written notice from such contractors of any revisions to scheduled completion of their work at least 30 days in advance. Owner will reimburse Contractor for expenses incurred by Contractor by failure to be properly notified.
- B. Owner has issued or will issue separate contracts for operations scheduled to be completed between Notice to Proceed and Substantial Completion.
1. General:
    - a. Schedule performance of work covered by such separate contracts in Contractor's Construction Schedule so as to avoid delays in Substantial Completion. Give written notice to such contractors and to Owner of any revisions to scheduled delivery and work dates at least 30 days in advance.
    - b. Complete work necessary to accommodate items provided under such separate contracts before scheduled date for performance of such work. Contractor will be back charged for actual expenses incurred by Owner for failure to timely complete such work including, but not limited to, cost of crews during downtime or for call backs and costs to correct substrate deficiencies.
    - c. Store and protect completed work provided under separate contracts until date of Substantial Completion.
  2. Testing and Inspection. See Section 01 4523 "Testing and Inspection" for testing and inspection, for materials, products, and construction methods:
    - a. Air System Testing, Adjusting, and Balance. See Section 01 4546.

**PART 2 - PRODUCTS Not Used****PART 3 - EXECUTION Not Used****END OF SECTION**

**SECTION 01 1400****WORK RESTRICTIONS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes But is Not Limited To:
1. Administrative and procedural requirements for Work Restrictions.

**1.2 PROJECT CONDITIONS**

- A. During construction period, Contractor will have use of premises for construction operations. Contractor will ensure that Contractor, its employees, subcontractors, and their employees comply with following requirements:
1. Confine operations to areas within Contract limits shown on Drawings. Do not disturb portions of site beyond Contract limits.
  2. Do not allow alcoholic beverages, illegal drugs, or persons under their influence on Project site.
  3. Do not allow use of tobacco in any form on Project Site.
  4. Do not allow pornographic or other indecent materials on site.
  5. Do not allow work on Project site on Sundays except for emergency work.
  6. Refrain from using profanity or being discourteous or uncivil to others on Project Site or while performing The Work.
  7. Wear shirts with sleeves, wear shoes, and refrain from wearing immodest, offensive, or obnoxious clothing, while on Project Site.
  8. Do not allow playing of obnoxious and loud music on Project Site. Do not allow playing of any music within existing facilities.
  9. Do not build fires on Project Site.
  10. Do not allow weapons on Project Site, except those carried by law enforcement officers or other uniformed security personnel who have been retained by Owner or Contractor to provide security services.
- B. Existing Facilities:
1. Reasonably accommodate use of existing facilities by Owner.
- C. Do not load or permit any part of the structure to be loaded with a weight that will endanger its safety. Questions of structural loading as part of construction means and methods shall be addressed by a licensed structural engineer engaged by Contractor, subject to the review by Architect.

**PART 2 - PRODUCTS Not Used****PART 3 - EXECUTION Not Used****END OF SECTION**

**SECTION 01 2900****PAYMENT PROCEDURES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes But is Not Limited To:
1. Administrative and procedural requirements to prepare and process Applications for Payments.

**1.2 PAYMENT REQUESTS**

- A. Use Payment Request forms provided by Owner.
- B. Each Payment Request will be consistent with previous requests and payments certified by Architect and paid for by Owner.
- C. Request Preparation:
1. Complete every entry on Payment Request form.
  2. Entries will match data on approved schedule of values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
  3. Submit signed Payment Request to Architect with current Construction Schedule.
- D. Provide following submittals before or with submittal of Initial Payment Request:
1. List of Subcontractors.
  2. Initial progress report.
  3. Contractor's Construction Schedule.
  4. Submittal Schedule.
- E. Provide Affidavit of Contractor and Consent of Surety with Payment Request following Substantial Completion.

**1.3 SCHEDULE OF VALUES**

- A. Submit schedule of values on Owner's standard form to Architect 20 days minimum before submission of Initial Payment Request as a necessary condition before payment will be processed. Coordinate preparation of schedule of values with preparation of Contractor's Construction Schedule. Correlate line items in Schedule of Values with other required administrative schedules and forms, including:
1. Contractor's Construction Schedule.
  2. Payment Request form.
  3. Schedule of Allowances.
  4. Schedule of Alternates.

**PART 2 - PRODUCTS Not Used****PART 3 - EXECUTION Not Used****END OF SECTION**



**SECTION 01 3100****PROJECT MANAGEMENT AND COORDINATION****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes But is Not Limited To:
  - 1. Administrative and procedural requirements for Project Management and Coordination on Projects.

**1.2 PROJECT COORDINATION**

- A. This Project designation will be included on documents generated for Project by Contractor and Subcontractors, or be present on a cover letter accompanying such documents.
- B. Project designation for this Project is Salem 1, 2 & 9 Wards.
- C. This Project designation will be included on documents generated for Project by Contractor and Subcontractors, or be present on a cover letter accompanying such documents.

**1.3 MULTIPLE CONTRACT COORDINATION**

- A. Contractor shall be responsible for accurately maintaining and reporting schedule of The Work from Notice to Proceed to date of Substantial Completion.
- B. Contractor shall be responsible for providing Temporary Facilities And Controls for those who perform work on Project from Notice to Proceed to date of Substantial Completion.
- C. Contractor shall be responsible for providing Construction Waste Management And Disposal services for those who perform work on Project from Notice to Proceed to date of Substantial Completion.
- D. Contractor shall be responsible for Final Cleaning for entire Project.

**1.4 PROJECT MEETINGS AND CONFERENCES**

- A. Preconstruction Conference:
  - 1. Attend preconstruction conference and organizational meeting scheduled by Architect at Project site or other convenient location.
  - 2. Be prepared to discuss items of significance that could affect progress, including such topics as:
    - a. Construction schedule.
    - b. Critical Work sequencing.
    - c. Current problems.
    - d. Designation of responsible personnel.
    - e. Distribution of Contract Documents.
    - f. Equipment deliveries and priorities.
    - g. General schedule of inspections by Architect and its consultants.
    - h. General inspection of tests.
    - i. Office, work, and storage areas.
    - j. Preparation of record documents and O & M manuals.
    - k. Procedures for processing interpretations and Modifications.
    - l. Procedures for processing Payment Requests.
    - m. Project cleanup.
    - n. Security.
    - o. Status of permits.
    - p. Submittal of Product Data, Shop Drawings, Samples, Quality Assurance / Control submittals.

- q. Use of the premises.
  - r. Work restrictions.
  - s. Working hours.
3. Architect will record minutes of meetings and distribute copies to Owner and Contractor within three (3) working days.
- B. Progress Meetings:
- 1. Attend progress meetings at Project site at regularly scheduled intervals determined by Architect, at least once a month.
  - 2. Progress meetings will be open to Owner, Architect, Subcontractors, and anyone invited by Owner, Architect, and Contractor.
  - 3. Be prepared to discuss items of significance that could affect progress, including following:
    - a. Progress since last meeting.
    - b. Whether Contractor is on schedule.
    - c. Activities required to complete Project within Contract Time.
    - d. Labor and materials provided under separate contracts.
    - e. Off-site fabrication problems.
    - f. Access.
    - g. Site use.
    - h. Temporary facilities and services.
    - i. Hours of work.
    - j. Hazards and risks.
    - k. Project cleanup.
    - l. Quality and Work standards.
    - m. Status of pending modifications.
    - n. Documentation of information for Payment Requests.
    - o. Maintenance of Project records.
  - 4. Architect will prepare minutes of progress meetings and distribute copies of minutes to Owner and Contractor within three (3) working days.
- C. Pre-Installation Conferences:
- 1. Attend pre-installation conferences specified in Contract Document.
    - a. If possible, schedule these conferences on same day as regularly scheduled Progress Meetings. If this is not possible, coordinate scheduling with Architect.
    - b. Request input from attendees in preparing agenda.
  - 2. Be prepared to discuss following items:
    - a. Requirements of Contract Documents.
    - b. Completed work necessary for installation of items or systems.
    - c. Conditions not in compliance with installation requirements.
    - d. Installation and inspection schedule.
    - e. Coordination between trades.
    - f. Space and access limitations.
    - g. Testing.
  - 3. Architect will prepare meeting minutes and distribute minutes to Owner and Contractor within three (3) working days.

**PART 2 - PRODUCTS Not Used**

**PART 3 - EXECUTION Not Used**

**END OF SECTION**

**SECTION 01 3200****CONSTRUCTION PROGRESS DOCUMENTATION****PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes But is Not Limited To:**

1. Administrative and procedural requirements for documenting the progress of construction during performance of the Work.

**1.2 SCHEDULING OF WORK****A. Bar Chart Schedule:**

1. Submit horizontal bar chart schedule before Preconstruction Conference. Provide separate time bar for each construction activity listed on Owner 's payment request form. Within each time bar, show estimated completion percentage. Provide continuous vertical line to identify first working day of each week. Show each activity in chronological sequence. Show graphically sequences necessary for completion of related portions of The Work. As The Work progresses, place contrasting mark in each bar to indicate actual completion.
2. Provide copies of schedule for Architect and Owner and post copy in field office.
3. Revise schedule monthly. Send copy of revised schedule to Owner and Architect and post copy in field office.
4. Project Management Software Programs:
  - a. Any software project management program capable of Bar Chart Scheduling for projects of equal size and complexity is approved by Contractor and approved by Owner's Project Manager.

**B. Network Analysis Schedule:**

1. General Requirements:
  - a. Submit and maintain Critical Path Method (CPM) schedule for the Work. Computerized network diagram will serve as 'Master Construction Schedule' for Project, giving mathematical analysis (printout) of that network, which verifies and validates logic and planning and defines critical path. Display accepted schedule in site construction office at all times.
  - b. Utilize CPM schedule for planning, organizing, and directing the Work, for reporting progress, and for requesting payment for work completed. Review schedule each month in progress meeting.
  - c. Clearly explain abbreviations used in CPM schedules in legend of symbols, either separate or attached.
  - d. Project Management Software Programs:
    - 1) Any software project management program capable of CPM Scheduling for projects of equal size and complexity is approved by Contractor and approved by Owner's Project Manager.
2. Schedule Requirements:
  - a. CPM schedule will clearly show sequential interdependencies, with activity duration and float clearly represented. Sequence(s) of activities with no float will be clearly identified as Critical Path(s).
  - b. Scheduling system will be capable of baseline comparison analysis. Upon development and acceptance of schedule, 'freeze' initial schedule as baseline schedule. As work progresses, provide graphics displaying actual progress bars versus baseline or target bars.
  - c. Activity durations will be in workdays.
  - d. Activity Content:
    - 1) CPM schedule will include but not be limited to following activities as they apply to Project.
      - a) Construction tasks (Maximum 20 day duration for any activity).

- b) Shop drawings submittal and approval process.
  - c) Ordering, fabrication, and delivery of major materials and equipment.
  - d) Checkout, start-up, and test and balance of major equipment.
  - e) Submittals of record drawings and maintenance manuals.
  - f) Cleanup and punch out tasks.
  - g) Critical coordination activities required to insure timely support and inspections.
  - h) Owner purchased/installed items and Owner's separate contract work.
  - i) Pre-final, final inspections and substantial completion.
  - j) Final payment.
  - k) Owner occupancy.
- 2) Schedule submittal activities to allow sufficient time for work to be procured and installed, even if submittal is unacceptable and re-submittal is required.
3. Submittals:
- a. Submit initial submittal, complete revisions, and periodic reports in three hard copies, one reproducible and two prints or plots, and one copy on CD or removable drive.
  - b. Submit completed network program consisting of PERT, GANTT, and mathematical analysis prior to preconstruction meeting.
  - c. Review development status of network CPM schedule with Owner and Architect during preparation period.
4. Report Formats:
- a. Standard set of reports submitted each month including initial submittals will consist of following:
    - 1) Graphics:
      - a) GANTT chart of entire project. Progress bar chart will include target or baseline comparison bars. Bar positions will be early start / early finish with float clearly defined.
      - b) Time-scaled logic diagram or time-scaled network, also called PERT chart, with critical path clearly defined.
      - c) PERT and GANTT charts will include tabulation of each activity. Furnish following information for each activity on PERT and GANTT charts. Sequencing of columns on GANTT chart will match following:
      - d) GANTT Chart Column Layout:
        - (1) Activity / Task Description.
        - (2) Estimated duration of activity / task.
        - (3) Start status.
        - (4) Status.
        - (5) Start date by calendar date.
        - (6) End date by calendar date.
        - (7) Latest start date by calendar date.
        - (8) Latest end date by calendar date.
        - (9) Total slack or float time in calendar days.
        - (10) Percentage of activity achieved.
      - e) Program or means used in making mathematical computation will compile total value of completed and partially completed activities. Program will also accept revised completion dates as modified by Change Order time adjustments and accompanying recomputations of float dates.
      - f) PERT Chart Box Layout:
        - (1) Task / Activity Name.
        - (2) Duration.
        - (3) Start Date.
        - (4) End Date.
        - (5) Status (critical task).
  - b. Graphics outlined above will comply with following criteria unless noted otherwise:
    - 1) Sheet size of diagram will be 24 by 36 inches minimum and time scaled in weeks unless approved otherwise.
    - 2) On each page include title block containing as minimum following information:
      - a) Project Title.
      - b) Project Number.
      - c) Contractor's Business Name.

- d) Date of Submittal and/or Revision.
  - e) Progress Computation Date.
  - f) Legend of Symbols and Abbreviations as applicable.
  - 3) Prepare and submit to Architect upon request additional charts, reports, and current copy on disk of Project program.
  - 5. CPM Schedule Implementation And Monitoring:
    - a. Where Contractor is shown to be behind schedule, provide accompanying written summary, cause, and explanation of planned remedial action.
      - 1) CPM schedules will reflect those instances, Modifications or other alterations to schedule, which have impact on final completion or interim target dates within schedule.
      - 2) Owner may withhold payments or portions of payments upon failure to maintain scheduled progress of the Work as shown on accepted CPM schedule.
    - b. Float time belongs to Project, not to Contractor or to Owner, and may be utilized by both parties.
  - 6. Schedule Changes And Updates:
    - a. Update CPM Schedule prior to each submittal to Owner and Architect. Correlate Schedule of Values graphically with CPM schedule for evaluation of monthly Payment Request.
    - b. Include additional activities added to CPM schedule by Contractor submitted schedule charts. It is Owner's intent that Project be managed and operated by CPM schedule.
- C. Daily Construction Reports:
- 1. Prepare daily reports of operations at Project including at least following information:
    - a. List of Subcontractors at site.
    - b. Approximate count of personnel at site by trade.
    - c. High and low temperatures, general weather conditions.
    - d. Major items of equipment on site.
    - e. Materials, equipment, or Owner-furnished items arriving at or leaving site.
    - f. Accidents and unusual events.
    - g. Site or structure damage by water, frost, wind, or other causes.
    - h. Meetings, conferences, and significant decisions.
    - i. Visitors to the job including meeting attendees.
    - j. Stoppages, delays, shortages, losses.
    - k. Any tests made and their result if known.
    - l. Meter readings and similar recordings.
    - m. Emergency procedures.
    - n. Orders and requests of governing authorities.
    - o. Modifications received, carried out.
    - p. Services connected, disconnected.
    - q. Equipment or system tests and start-ups.
    - r. Brief summary of work accomplished that day.
    - s. Signature of person preparing report.
  - 2. Submit daily reports to Architect at least weekly.
  - 3. Maintain copies of daily reports at field office.

**PART 2 - PRODUCTS Not Used**

**PART 3 - EXECUTION Not Used**

**END OF SECTION**

**SECTION 01 3300****SUBMITTAL PROCEDURES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes But is Not Limited To:
  - 1. Administrative and procedural requirements for Submittal Procedures.
- B. Related Requirements:
  - 1. Section 01 7800: 'Closeout Submittals' for administrative and procedural requirements for closeout submittals.

**1.2 SUBMITTAL SCHEDULE**

- A. Furnish submittal schedule within 20 days after receipt of Notice to Proceed, listing items specified to be furnished for review to Architect including product data, shop drawings, samples, and Informational submittals.
  - 1. Coordinate submittal schedule with Contractor's construction schedule.
  - 2. Enclose the following information for each item:
    - a. Scheduled date for first submittal.
    - b. Related Section number.
    - c. Submittal category.
    - d. Name of Subcontractor.
    - e. Description of part of the Work covered.
    - f. Scheduled date for resubmittal.
    - g. Scheduled date for Architect's final release or approval.
- B. Print and distribute copies to Architect and Owner and post copy in field office. When revisions are made, distribute to same parties and post in same location.
- C. Revise schedule monthly. Send copy of revised schedule to Owner and Architect and post copy in field office.

**1.3 SUBMITTAL PROCEDURES**

- A. Coordination:
  - 1. Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently before performance of related construction activities to avoid delay.
    - a. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
    - b. Coordinate transmittal of different types of submittals required for related elements of The Work so processing will not be delayed by need to review submittals concurrently for coordination. Architect reserves right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
  - 2. Processing Time:
    - a. Allow sufficient review time so installation will not be delayed by time required to process submittals, including time for resubmittals.
      - 1) Allow 21 days for initial review. Allow additional time if processing must be delayed allowing coordination with subsequent submittals. Architect will promptly advise Contractor when submittal being processed must be delayed for coordination.
      - 2) If an intermediate submittal is necessary, process same as initial submittal.
      - 3) Allow 10 days for reprocessing each submittal.

- 4) No extension of Contract Time will be authorized because of failure to transmit submittals to Architect in sufficient time before work is to be performed to allow processing.
3. Identification:
  - a. Place permanent label or title block on each submittal for identification. Include name of entity that prepared each submittal on label or title block.
    - 1) Provide space approximately 4 by 5 inches on label or beside title block on Shop Drawings to record Contractor's review and approval markings and action taken.
    - 2) Include following information on label for processing and recording action taken:
      - a) Project name.
      - b) Date.
      - c) Name and address of Architect.
      - d) Name and address of Contractor.
      - e) Name and address of Subcontractor.
      - f) Name and address of supplier.
      - g) Name of manufacturer.
      - h) Number and title of appropriate Specification Section.
      - i) Drawing number and detail references, as appropriate.
4. Transmittal:
  - a. Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Architect using transmittal letter. On transmittal, record relevant information and requests for data. Include Contractor's certification that information complies with Contract Document requirements, or, on form or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations.
  - b. Submittals received from sources other than Contractor or not marked with Contractor's approval will be returned without action.

#### 1.4 ACTION SUBMITTALS

- A. Product Data:
  1. Submit Product Data, as required by individual Sections of Specifications.
  2. Mark each copy of each set of submittals to show choices and options used on Project. Where printed Product Data includes information on products that are not required for Project, mark copies to indicate information relating to Project.
  3. Certify that proposed product complies with requirements of Contract Documents. List any deviations from those requirements on form or separate sheet.
  4. Submit five copies of each required submittal unless otherwise required. Architect will return three copies marked with action taken and with corrections or modifications required.
  5. Submit electronic files PDF: Architect will return a PDF copy marked with action taken and with corrections or modifications required.
- B. Shop Drawings:
  1. Submit newly prepared graphic data to accurate scale. Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 36 by 48 inches. Highlight, encircle, or otherwise show deviations from Contract Documents. Include following information as a minimum:
    - a. Dimensions.
    - b. Identification of products and materials included.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions established by field measurement.
  2. Do not reproduce Contract Documents or copy standard information as basis of Shop Drawings. Standard printed information prepared without specific reference to Project is not acceptable as Shop Drawings.
  3. Review and designate (stamp) approval of shop drawings. Unless otherwise specified, submit to Architect six copies of shop drawings required by Contract Documents. Shop drawings not required by Contract Documents, but requested by Contractor or supplied by Subcontractor, need not be submitted to Architect for review.

C. Samples:

1. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
  - a. Mount, display, or package Samples to ease review of qualities specified. Prepare Samples to match samples provided by Architect, if applicable. Include following:
    - 1) Generic description of Sample.
    - 2) Sample source.
    - 3) Product name or name of manufacturer.
    - 4) Compliance with recognized standards.
    - 5) Availability and delivery time.
2. Submit Samples for review of kind, color, pattern, and texture, for final check of these characteristics with other elements, and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
  - a. Where variations in color, pattern, texture or other characteristics are inherent in material or product represented, submit set of three samples minimum that show approximate limits of variations.
  - b. Refer to other specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.
  - c. Refer to other Sections for Samples to be returned to Contractor for incorporation into The Work. Such Samples shall be undamaged at time of use. On transmittal, indicate special requests regarding disposition of Sample submittals.
3. Where Samples are for selection of color, pattern, texture, or similar characteristics from a range of standard choices, submit full set of choices for material or product. Preliminary submittals will be reviewed and returned with Architect's mark indicating selection and other action.
4. Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit three sets. One will be returned marked with action taken.
5. Samples, as accepted and returned by Architect, will be used for quality comparisons throughout course of construction.
  - a. Unless noncompliance with Contract Documents is observed, submittal may serve as final submittal.
  - b. Sample sets may be used to obtain final acceptance of construction associated with each set.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Informational submittals are design data, test reports, certificates, manufacturer's instructions, manufacturer's field reports, and other documentary data affirming quality of products and installations. Submit five copies of each required submittal unless otherwise required. Architect will return three copies marked with action taken and with corrections or modifications required. [or] Submit electronic files: PDF. Architect will return a PDF copy marked with action taken and with corrections or modifications required.
1. Certificates: Describe certificates intended to document affirmations by Contractor or others that the work is in accordance with the Contract Documents, but do not repeat provisions of Parts 2 or 3.
  2. Delegated Design Submittals / Design Data: Describe submittals intended to demonstrate design work prepared by Contractor's licensed professionals.
  3. Test And Evaluation Reports: Describe submittal of test reports or evaluation service reports intended to document required tests.
  4. Manufacturer Instructions: Describe submittals intended to document manufacturer instructions.
  5. Source Quality Control Submittals: Describe submittal of source quality control documentation.
  6. Field Quality Control Submittals: Describe submittal of field quality control documentation.
  7. Manufacturer Reports: Describe submittal of Manufacturer reports as documentation of manufacturer activities.
  8. Special Procedure Submittals: Describe submittals intended to document special procedures. An example would be construction staging or phasing for remodeling an existing facility while



- keeping it in operation. While the Contractor would normally be responsible for managing this, submittal of his plan as documentation could be specified.
9. Qualification Statements: Describe submittals intended to document qualifications of entities employed by Contractor.

## 1.6 CLOSEOUT SUBMITTALS

- A. This title groups submittals that occur during project closeout. Coordinate with section 01 7800 Closeout Submittals.
  1. As Built Record Drawings as defined in the Agreement.
  2. Project Manual: Complete Project Manual including Addenda and Modifications as defined in General Conditions.
  3. Maintenance Contracts: Describe submittal of the maintenance contract specific to the Section.
  4. Operations & Maintenance Data: Describe submittal of operation and maintenance data necessary for products of the Section.
  5. Warranty Documentation: Describe submittal of final executed warranty document specific to the Section.
  6. Record Documentation: Describe submittal of record documentation specific to the Section.
  7. Software: Describe submittal system software and programming software specific to the Section.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. This title groups maintenance material required submittals specific to the Section. Items may be provided at completion of Work or submitted with section 01 7800 Closeout Submittals:
  1. Spare Parts: Describe spare parts necessary for Owner's use in facility operation and maintenance. 'Parts' are generally understood to be items such as filters, motor drive belts, lamps, and other similar manufactured items that require only simple replacement.
  2. Extra Stock Materials: Describe extra stock materials to be provided for Owner's use in facility operation and maintenance. Extra stock materials are generally understood to be items such as ceiling tiles, flooring, paint etc.
  3. Tools:
    - a. Describe tools to be provided for Owner's use in facility operation and maintenance. Tools are generally understood to be wrenches, gauges, circuit setters, etc, required for proper operation or maintenance of a system.

**PART 2 - PRODUCTS Not Used**

**PART 3 - EXECUTION Not Used**

**END OF SECTION**

**SECTION 01 3500****SPECIAL PROCEDURES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes But is Not Limited To:
1. Administrative and procedural requirements for Special Procedures.

**1.2 REFERENCES**

- A. Association Publications:
1. U.S. Department of Labor, Occupational Safety and Health Administration:
    - a. 29 CFR 1926 OSHA, 'Construction Industry Regulations' (January 2014 or latest version).
      - 1) 29 CFR 1926.20, 'General Safety And Health Provisions'.
      - 2) 29 CFR 1926.64, 'Hot Work Permit'.
      - 3) 29 CFR 1926.352, 'Fire Prevention'.
      - 4) 29 CFR 1926.500, 'Fall Protection'.

**1.3 ADMINISTRATIVE REQUIREMENTS**

- A. Acceleration of Work:
1. Complete The Work in accordance with Construction Schedule. If Contractor falls behind schedule, take such actions as are necessary, at no additional expense to Owner, to bring progress of The Work back in accordance with schedule.
  2. Owner may request proposal for completion of The Work at date earlier than expiration of Contract Time:
    - a. Promptly provide requested proposal showing cost of such acceleration of The Work. Consult with Owner and Architect regarding possible options to decrease cost of such acceleration.
    - b. If Owner determines to order acceleration of The Work, change in Contract Sum and Contract Time resulting from acceleration will be included in a Change Order.

**1.4 QUALITY ASSURANCE**

- A. Regulatory Agency Sustainability Approvals:
1. Meet regulations of 29 CFR 1926 OSHA, 'Construction Industry Regulations'.
  2. Owner's Safety Requirements:
    - a. Personal Protection:
      - 1) Contractor shall ensure:
        - a) Positive means of fall protection, such as guardrails system, safety net system, personal fall arrest system, etc, is provided to employees whenever exposed to a fall 6 feet or more above a lower level.
        - b) Personnel working on Project shall wear hard hats and safety glasses as required by regulation and hazard.
        - c) Personnel working on Project shall wear long or short sleeve shirts, long pants, and hard-toed boots or other sturdy shoes appropriate to type and phase of work being performed.
      - b. Contractor Tools And Equipment:
        - 1) Contractor shall ensure:
          - a) Tools and equipment are in good working condition, well maintained, and have necessary guards in place.
          - b) Ground Fault Circuit Interrupters (GFCI) is utilized on power cords and tools.
          - c) Scaffolding and man lifts are in good working condition, erected and maintained as required by governmental regulations.

- d) Ladders are in good condition, well maintained, used as specified by Manufacturer, and secured as required.
- c. Miscellaneous:
  - 1) Contractor shall ensure:
    - a) Protection is provided on protruding rebar and other similar objects.
    - b) General Contractor Superintendent has completed the OSHA 10-hour construction outreach training course or equivalent.
    - c) Implementation and administration of safety program on Project.
    - d) Material Safety Data Sheets (MSDS) are provided for substances or materials for which an MSDS is required by governmental regulations before bringing on site.
    - e) Consistent safety training is provided to employees on Project.
    - f) Implement and coordinate Lockout / Tagout procedures with Owner's Representative as required.
  - 2) Report accidents involving injury to employees on Project that require off-site medical treatment to Owner's designated representative.
- d. Hot Work Permit:
  - 1) Permit shall document that fire prevention and protection requirements in 29 CFR 1926.352, 'Fire Prevention' have been implemented prior to beginning hot work operations.
  - 2) Required for doing hot work involving open flames or producing heat or sparks such as:
    - a) Brazing.
    - b) Cutting.
    - c) Grinding.
    - d) Soldering.
    - e) Thawing pipe.
    - f) Torch applied roofing.
    - g) Welding.

**PART 2 - PRODUCTS Not Used**

**PART 3 - EXECUTION Not Used**

**END OF SECTION**

**SECTION 01 4000****QUALITY REQUIREMENTS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Related Requirements:
  - 1. Section 01 3100: 'Project Management and Coordination' for Pre-Installation Conferences for testing and inspection.
  - 2. Section 01 3200: 'Construction Progress Documentation' for developing a schedule of required tests and inspections.
  - 3. Section 01 3300: 'Submittal Procedures'.
  - 4. Section 01 4301: 'Quality Assurance – Qualifications' establishes minimum qualification levels required.
  - 5. Section 01 4523: 'Testing and Inspecting Services' for testing and inspection, and testing laboratory services for materials, products, and construction methods.
  - 6. Section 01 7300: 'Executions' for cutting and patching for repair and restoration of construction disturbed by testing and inspecting activities.
  - 7. Divisions 01 thru 49 establish responsibility for providing specific testing and inspections.

**1.3 REFERENCES**

- A. Definitions:
  - 1. Accreditation: Process in which certification of competency, authority, or credibility is presented. Verify that laboratories have an appropriate quality management system and can properly perform certain test methods (e.g., ANSI, ASTM, and ISO test methods) and calibration parameters according to their scopes of accreditation.
  - 2. Approved: To authorize, endorse, validate, confirm, or agree to.
  - 3. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with requirements indicated; and having complied with requirements of authorities having jurisdiction.
  - 4. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a construction operation, including installation, erection, application, and similar operations.
    - a. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to trades people of corresponding generic name.
  - 5. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish standard by which the Work will be judged.
  - 6. Observation: Visual observation of building / site elements or structural system by registered design professional for general conformance to approved construction documents at significant construction stages and at completion. Observation does not include or waive responsibility for performing inspections or special inspections.

7. Preconstruction Testing: Tests and inspections that are performed specifically for Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
8. Product Testing: Tests and inspections that are performed by testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
9. Service Provider: Agency or firm qualified to perform required tests and inspections.
10. Source Quality Control Testing: Tests and inspections that are performed at source, i.e., plant, mill, factory, or shop.
11. Testing Agency: Entity engaged to perform specific tests, inspections, or both.
12. Testing Agency Laboratory: Agency or firm qualified to perform field and laboratory tests to determine characteristics and quality of materials and workmanship.
13. Verification: Act of reviewing, inspecting, testing, etc. to establish and document that product, service, or system meets regulatory, standard, or specification requirements.

B. Reference Standards:

1. International Code Council (IBC) (2015 or most recent edition adopted by AHJ):
  - a. IBC Chapter 17, 'Structural Tests and Special Inspections'.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

A. Conflicting Requirements:

1. General:
  - a. If compliance with two or more standards is specified and standards establish different or conflicting requirements for minimum quantities or quality levels, comply with most stringent requirement.
  - b. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
2. Minimum Quantity or Quality Levels:
  - a. Quantity or quality level shown or specified shall be minimum provided or performed.
  - b. Actual installation may comply exactly with minimum quantity or quality specified, or it may exceed minimum within reasonable limits.
  - c. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for context of requirements.
  - d. Refer uncertainties to Architect for decision before proceeding.

B. Coordination:

1. Coordinate sequence of activities to accommodate required quality assurance and quality control services with minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

C. Scheduling:

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

#### 1.5 QUALITY ASSURANCE

A. Testing and inspecting services are used to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.

1. Specific quality assurance and quality control requirements for individual construction activities are specified in Sections that specify those activities and Section 01 4523. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality control procedures that facilitate compliance with Contract Document requirements.
3. Requirements for Contractor to provide quality assurance and quality control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

B. Quality Assurance Services:

1. Activities, actions, and procedures performed before and during execution of the Work to verify compliance and guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
  2. Owner or Owner's designated representative(s) will perform quality assurance to verify compliance with Contract Documents.
- C. Activities performed by Owner's Quality Assurance Testing Agency include, but are not limited to following:
1. Individual Sections in Division 01 through Division 49:
    - a. Pre-Installation Conference agenda review items for:
      - 1) Schedule requirements.
      - 2) Testing and inspection requirements:
      - 3) Requirements and frequency of testing and inspections.
      - 4) Mock-up or sample requirements.
      - 5) Submittals requirements.
    - b. Quality Assurance personal qualifications.
      - 1) Qualification documentation including certificates if required.
    - c. Non-Conforming Work:
      - 1) Prepare non-compliance log to track non-compliant testing or inspections.
  2. Weekly Activities:
    - a. Summarize and track any non-compliance issues.
    - b. Provide summary report of previous week's performed Work.
    - c. Visit contractors periodically to find out if they have any concerns with Quality Assurance inspectors and check on any schedule changes.
    - d. Visit Owner's Representatives periodically to find out if they have any concerns with how project is progressing.
- D. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with following requirements, using materials indicated for completed Work:
1. Coordinate with individual section in Division 01 through Division 49 if there are any additional requirements or modification to these requirements:
    - a. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
    - b. Notify Architect seven days in advance of dates and times when mockups will be constructed.
    - c. Demonstrate proposed range of aesthetic effects and workmanship.
    - d. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
      - 1) Allow seven days for initial review and each re-review of each mockup.
    - e. Maintain mockups during construction in undisturbed condition as standard for judging completed Work.
      - 1) Demolish and remove mockups when directed, unless otherwise indicated.

## 1.6 QUALITY CONTROL

- A. Quality Control Services:
1. Quality Control will be sole responsibility of Contractor.
    - a. Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements performed by Contractor:
      - 1) They do not include inspections, tests or related actions performed by Architect, Owner, governing authorities or independent agencies hired by Owner or Architect.
      - 2) Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor.
    - b. Where services are indicated as Contractor's responsibility, engage a qualified Testing Agency to perform these quality control services.
      - 1) Contractor shall not employ same testing entity engaged by Owner, without Owner's written approval.

- B. **Manufacturer's Field Services:** Where indicated, engage factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 3300: 'Submittal Procedures'.
- C. **Associated Services:** Cooperate with agencies performing required tests, inspections, and similar quality control services, and provide reasonable auxiliary services as requested. Notify Testing Agency sufficiently in advance of operations to permit assignment of personnel. Provide following:
  - 1. Access to the Work.
  - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
  - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist Testing Agency in obtaining samples.
  - 4. Facilities for storage and field curing of test samples.
  - 5. Delivery of samples to testing agencies.
  - 6. Preliminary design mix proposed for use for material mixes that require quality control by Testing Agency.
  - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- D. **Testing Agency Responsibilities:** Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections:
  - 1. **Civil And Structural Testing:**
    - a. Civil and structural field tests, laboratory testing, and inspections are provided by Owner's independent Testing Agency as specified in Section 01 4523 'Testing And Inspection Services'. Quality Control is sole responsibility of Contractor:
      - 1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
        - a) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.
      - 2) Contractor bears full responsible for compliance with all contract requirements and quality control on project and will be responsible for quality of asphalt mixture and asphalt installation.
    - b. **Weekly Activities:**
      - 1) Ensure that non-compliance log is current.
      - 2) Provide summary reports of performed Work.

## **PART 2 - PRODUCTS Not Used**

## **PART 3 - EXECUTION**

### **3.1 REPAIR AND PROTECTION**

- A. **General:** On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
  - 1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
  - 2. Comply with Contract Document requirements for Section 01 7300 'Execution' for cutting and patching.
- B. Protect construction exposed by or for Quality Assurance and Quality Control activities.
- C. Repair and protection are Contractor's responsibility, regardless of assignment of responsibility for Quality Assurance and Quality Control Services.

**END OF SECTION**

**SECTION 01 4200****REFERENCES****PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes But is Not Limited To:**

1. Reference standards, definitions, specification format, and industry standards.

**1.2 REFERENCES****A. Definitions:**

1. **Approved:** The term "approved," when used to convey Architect's action on Contractor's submittals, applications, and requests, is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
2. **Directed:** The term "directed" is a command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," and "permitted" have the same meaning as "directed."
3. **Experienced:** The term "experienced," when used with an entity, means having successfully completed a minimum often previous projects similar in size and scope to this Project; being familiar with the special requirements indicated, and having complied with requirements of authority having jurisdiction.
4. **Furnish:** The term "furnish" means supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
5. **General:** Basic Contract definitions are included in the Conditions of the Contract.
6. **Indicated:** The term "indicated" refers to requirements expressed by graphic representations, or in written form on Drawings, in Specifications, and in other Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference.
7. **Install:** The term "install" describes operations at Project site including unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
8. **Installer:** An "Installer" is the Contractor or another entity engaged by the Contractor, as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
9. **Project Site:** The term "Project site" means the space available for performing construction activities. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
10. **Provide:** The term "provide" means to furnish and install, complete and ready for the intended use.
11. **Regulations:** The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
12. **Submitted:** The terms "submitted," "reported," "satisfactory" and similar words and phrases means submitted to Architect, reported to Architect and similar phrases.
13. **Testing Agencies:** A "testing agency" is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, or to report on and, if required, to interpret results of those inspections or tests.
14. **Trades:** Using terms such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

**B. References Standards:**



1. Specification Format: Specifications will follow MasterFormat™ 2004 for organizing numbers and titles. (The Construction Specifications Institute, Project Resource Manual/CSI Manual of Practice, 5<sup>th</sup> Edition. New York, McGraw-Hill, 2005).
  - a. Specification Identifications:
    - 1) The Specifications use section numbers and titles to help cross referencing in the Contract Documents.
    - 2) Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.
  - b. Specification Language:
    - 1) Specifications should be prepared, with concern and respect for their legal status. Specifications should be Clear, Concise, Correct and Complete.
    - 2) Streamlining: Streamlining is used to list products, materials, reference standards, and other itemized specifications. This technique places the subject first and provides keywords for quick reference
  - c. Sentence Structure:
    - 1) Specifications to be written in the “Imperative Mood”.
      - a) The verb that clearly defines the action becomes the first word in the sentence.
      - b) The imperative sentence is concise and readily understandable.
    - 2) Streamlining is used to list products, materials, reference standards, and other itemized specifications. This technique places the subject first and provides keywords for quick reference.
  - d. Abbreviated Language:
    - 1) Abbreviations should be used only on drawings and schedules where space is limited.
    - 2) Abbreviations with multiple meanings should be avoided, unless used in different disciplines where their meaning is clear from the context in which they are used.
    - 3) Abbreviations should be limited to five or fewer letters
      - a) The verb that clearly defines the action becomes the first word in the sentence.
  - e. Symbols:
    - 1) Caution should apply to symbols substituted for words or terms.
  - f. Numbers:
    - 1) The use of Arabic numerals rather than words for numbers is recommended.

C. Industry Standards:

1. Except where Contract Documents specify otherwise, construction industry standards will apply and are made a part of Contract Documents by reference.
2. Where compliance with two or more standards is specified and standards apparently establish different or conflicting requirements for minimum quantities or quality levels, refer to Architect for decision before proceeding. Quantity or quality level shown or specified will be minimum provided or performed. Actual installation may comply exactly with minimum quantity or quality specified, or it may exceed minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for context of requirements. Refer uncertainties to Architect for decision before proceeding.
3. Each entity engaged in construction on Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with Contract Documents. Where copies of standards are needed for performance of a required construction activity, Contractor will obtain copies directly from publication source.
4. Trade Association names and titles of general standards are frequently abbreviated. The following acronyms or abbreviations, as referenced in Contract Documents, are defined to mean association names. Names and addresses are subject to change and are believed to be, but are not assured to be, accurate and up to date as of date of Contract Documents.

AABC	Associated Air Balance Council	Washington	DC	(202) 737-0202	<a href="http://www.aabchq.com">www.aabchq.com</a>
AAMA	American Architectural Manufacturers Association	Schaumburg	IL	(847) 303-5664	<a href="http://www.aamanet.org">www.aamanet.org</a>

AASHTO	American Association of State Highway & Transportation Officials	Washington	DC	(202) 624-5800	<a href="http://www.aashto.org">www.aashto.org</a>
AAMA	American Architectural Manufacturers Association	Schaumburg	IL	(847) 303-5774	<a href="http://www.aamanet.org">www.aamanet.org</a>
AASHTO	American association of State Highways and Transportation Officials	Washington	DC		<a href="http://www.transportation.org">www.transportation.org</a> <a href="http://www.aashto.org">www.aashto.org</a>
ACI	American Concrete Institute International	Farmington Hills	MI	(248) 848-3700	<a href="http://www.aci-int.org">www.aci-int.org</a>
AGA	American Gas Association	Washington	DC	(202) 824-7000	<a href="http://www.aga.org">www.aga.org</a>
AHRI	Air Conditioning Heating & Refrigeration Institute	Arlington	VA	(703) 524-8800	<a href="http://www.ari.org">www.ari.org</a>
AIA	American Institution of Architects	Washington	DC	(202) 626-7300	<a href="http://www.aia.org">www.aia.org</a>
AISC	American Institute of Steel Construction	Chicago	IL	(312) 670-2400	<a href="http://www.aisc.org">www.aisc.org</a>
AISI	American Iron & Steel Institute	Washington	DC	(202) 452-7100	<a href="http://www.steel.org">www.steel.org</a>
AITC	American Institution of Timber Construction	Englewood	CO	(303) 792-9559	<a href="http://www.aitc-glulam.org">www.aitc-glulam.org</a>
AMCA	Air Movement & Control Association International	Arlington Heights	IL	(847) 394-0150	<a href="http://www.amca.org">www.amca.org</a>
ANSI	American National Standards Institute	New York	NY	(212) 642-4900	<a href="http://www.ansi.org">www.ansi.org</a>
APA	APA-Engineered Wood Association	Tacoma	WA	(253) 565-6600	<a href="http://www.apawood.org">www.apawood.org</a>
API	American Petroleum Institute	Washington	DC	(202) 682-8000	<a href="http://www.api.org">www.api.org</a>
AQMD	South Coast Air Quality Management District	Diamond Bar	CA	(909) 396-2000	<a href="http://www.aqmd.gov">www.aqmd.gov</a>
ASHRAE	American Society of Heating, Refrigerating, & Air-Conditioning Engineers	Atlanta	GA	(404) 636-8400	<a href="http://www.ashrae.org">www.ashrae.org</a>
ASME	American Society of Mechanical Engineers International	New York	NY	(800) 843-2763	<a href="http://www.asme.org">www.asme.org</a>
ASTM	ASTM International	West Conshohocken	PA	(610) 832-9500	<a href="http://www.astm.org">www.astm.org</a>
AWI	Architectural Woodwork Institute	Potomac Falls	VA	(571) 323-3636	<a href="http://www.awinet.org">www.awinet.org</a>
AWPA	American Wood Protection Association	Birmingham	AL	(205) 733-4077	<a href="http://www.awpa.com">www.awpa.com</a>
AWS	American Welding Society	Miami	FL	(800) 443-9353	<a href="http://www.aws.org">www.aws.org</a>
AWWA	American Water Works Assoc	Denver	CO	(303) 794-7711	<a href="http://www.awwa.org">www.awwa.org</a>
BHMA	Builders Hardware Manufacturers Association	New York	NY	(212) 297-2122	<a href="http://www.buildershardware.com">www.buildershardware.com</a>
BIA	Brick Industry Association	Reston	VA	(703) 620-0010	<a href="http://www.bia.org">www.bia.org</a>
CFI	International Certified Floorcovering Installers, Inc.	Kansas City	MO	(816) 231-4646	<a href="http://www.cfi-installers.org">www.cfi-installers.org</a>
CRI	Carpet & Rug Institution	Dalton	GA	(706) 278-3176	<a href="http://www.carpet-rug.com">www.carpet-rug.com</a>
CRSI	Concrete Reinforcing Steel Institute	Schaumburg	IL	(847) 517-1200	<a href="http://www.crsi.org">www.crsi.org</a>
CISPI	Cast Iron Soil Pipe Institute	Chattanooga	TN	(423) 892-0137	<a href="http://www.cispi.org">www.cispi.org</a>
DHI	Door & Hardware Institute	Chantilly	VA	(703) 222-2010	<a href="http://www.dhi.org">www.dhi.org</a>
DIPRA	Ductile Iron Pipe Research Association.	Birmingham	AL	(205) 402-8700	<a href="http://www.dipra.org">www.dipra.org</a>

EIMA	EIFS Industry Members Association	Morrow	GA	(800) 294-3462	<a href="http://www.eima.com">www.eima.com</a>
FM	FM Global	Johnston	RI	(401) 275-3000	<a href="http://www.fmglobal.com">www.fmglobal.com</a>
FSC	Forest Stewardship Council	Bonn, Germany		+49 (0) 228 367 66 0	<a href="http://www.fsc.org">www.fsc.org</a>
GA	Gypsum Association	Hyattsville	MD	(301) 277-8686	<a href="http://www.gypsum.org">www.gypsum.org</a>
GS	Green Seal	Washington	DC	(202) 872-6400	<a href="http://www.greenseal.org">www.greenseal.org</a>
HPVA	Hardwood Plywood & Veneer Association	Reston	VA	(703) 435-2900	<a href="http://www.hpva.org">www.hpva.org</a>
ICC	International Code Council	Washington	DC	(888) 422-7233	<a href="http://www.iccsafe.org">www.iccsafe.org</a>
ICC-ES	ICC Evaluation Service	Whittier	CA	(562) 699-0543	<a href="http://www.icc-es.org">www.icc-es.org</a>
ICBO	International Conference of Building Officials				(See ICC)
ISO	International Organization for Standardization	Geneva, Switzerland			<a href="http://www.iso.org">www.iso.org</a>
ISSA	International Slurry Surfacing Association	Annapolis	MD	(410) 267-0023	<a href="http://www.slurry.org">www.slurry.org</a>
KCMA	Kitchen Cabinet Manufacturers Association	Reston	VA	(703) 264-1690	<a href="http://www.kcma.org">www.kcma.org</a>
LPI	Lightning Protection Institute	Maryville	MO	(800) 488-6864	<a href="http://www.lightning.org">www.lightning.org</a>
MFMA	Maple Flooring Manufacturers' Association	Deerfield	IL	(888) 480-9138	<a href="http://www.maplefloor.org">www.maplefloor.org</a>
MSS	Manufacturer's Standardization Society of The Valve and Fittings Industry	Vienna	VA	(703) 281-6613	<a href="http://www.mss-hq.com">www.mss-hq.com</a>
NAAMM	National Association of Architectural Metal Manufacturers	Glen Ellyn	IL	(630) 942-6591	<a href="http://www.naamm.org">www.naamm.org</a>
NEC	National Electric Code	(from NFPA).			
NEMA	National Electrical Manufacturer's Association	Rosslyn	VA	(703) 841-3200	<a href="http://www.nema.org">www.nema.org</a>
NFPA	National Fire Protection Association	Quincy	MA	(800) 344-3555	<a href="http://www.nfpa.org">www.nfpa.org</a>
NFRC	National Fenestration Rating Council	Greenbelt	MD	(301) 589-1776	<a href="http://www.nfrc.org">www.nfrc.org</a>
NSF	NSF International	Ann Arbor	MI	(734) 769-8010	<a href="http://www.nsf.org">www.nsf.org</a>
PCA	Portland Cement Association	Skokie	IL	(847) 966-6200	<a href="http://www.cement.org">www.cement.org</a>
PCI	Precast / Prestressed Concrete Institute	Chicago	IL	(312) 786-0300	<a href="http://www.pci.org">www.pci.org</a>
PEI	Porcelain Enamel Institute	Norcross	GA	(770) 676-9366	<a href="http://www.porcelainenamel.com">www.porcelainenamel.com</a>
RFCI	Resilient Floor Covering Institute	LaGrange	GA	(706) 882-3833	<a href="http://www.rfci.com">www.rfci.com</a>
SCTE	Society of Cable Telecommunications Engineers	Exton	PA	(800) 542-5040	<a href="http://www.scte.org">www.scte.org</a>
SDI	Steel Deck Institute	Fox River Grove	IL	(847) 458-4647	<a href="http://www.sdi.org">www.sdi.org</a>
SDI	Steel Door Institute	Westlake	OH	(440) 899-0010	<a href="http://www.steeldoor.org">www.steeldoor.org</a>
SIGMA	Sealed Insulating Glass Manufacturer's Association	Chicago	IL	(312) 644-6610	<a href="http://www.arcat.com">www.arcat.com</a>
SJI	Steel Joist Institute	Myrtle Beach	SC	(843) 293-1995	<a href="http://www.steeljoist.org">www.steeljoist.org</a>
SMACNA	Sheet Metal & Air Conditioning Contractors National Association	Chantilly	VA	(703) 803-2980	<a href="http://www.smacna.org">www.smacna.org</a>
SPIB	Southern Pine Inspection Bureau	Pensacola	FL	(850) 434-2611	<a href="http://www.spib.org">www.spib.org</a>

SSMA	Steel Stud Manufacturer's Association	Glen Ellyn	IL	(630) 942-6592	<a href="http://www.ssma.com">www.ssma.com</a>
TCNA	Tile Council of North America	Anderson	SC	(864) 646-8453	<a href="http://www.tileusa.com">www.tileusa.com</a>
TPI	Truss Plate Institute	Alexandria	VA	(703) 683-1010	<a href="http://www.tpinst.org">www.tpinst.org</a>
TPI	Turfgrass Producers International (formally American Sod Producers Association)	East Dundee	IL	(847) 649-5555	<a href="http://www.turfgrassod.org">www.turfgrassod.org</a>
UL	Underwriters Laboratories	Camas	WA	(877) 854-3577	<a href="http://www.ul.com">www.ul.com</a>
WDMA	Window and Door Manufacturer's Association	Chicago	IL	(312) 321-6802	<a href="http://www.nwwda.org">www.nwwda.org</a>
WWPA	Western Wood Products Association	Portland	OR	(503) 224-3930	<a href="http://www.wwpa.org">www.wwpa.org</a>

D. Federal Government Agencies:

- Names and titles of federal government standard or specification producing agencies are often abbreviated. Following acronyms or abbreviations referenced in Contract Documents represent names of standard or specification producing agencies of federal government. Names and addresses are subject to change but are believed to be, but are not assured to be, accurate and up to date as of date of Contract Documents.

CS	Commercial Standard (U S Department of Commerce)	Washington	DC	(202) 512-0000	<a href="http://www.doc.gov">www.doc.gov</a>
EPA	Environmental Protection Agency	Washington	DC	(202) 272-0167	<a href="http://www.epa.gov">www.epa.gov</a>
FCC	Federal Communications Commission	Washington	DC	(888) 225-5322	<a href="http://www.fcc.gov">www.fcc.gov</a>
FS	Federal Specifications Unit (Available from GSA)	Washington	DC	(202) 619-8925	<a href="http://www.gsa.gov">www.gsa.gov</a>
MIL	Military Standardization Documents (U S Department of Defense)	Philadelphia	PA	(215) 697-2179	<a href="http://www.dod.gov">www.dod.gov</a>
NIST	National Institute of Standards and Technology, technology Administration (US Department of Commerce)	Gaithersburg	MD	(301) 975-4500	<a href="http://www.ts.nist.gov">www.ts.nist.gov</a>
OSHA	Occupational Safety & Health Administration (U S Department of Labor)	Washington	DC	202) 219-8148	<a href="http://www.osha.gov">www.osha.gov</a>
PS	Product Standard of NBS (U S Department of Commerce)	Washington	DC	(202) 512-1800	<a href="http://www.doc.gov">www.doc.gov</a>

E. Governing Regulations / Authorities:

- Contact authorities having jurisdiction directly for information and decisions having a bearing on the Work.
- Obtain copies of regulations required to be retained at Project Site, available for reference by parties who have a reasonable need for such reference.

**PART 2 - PRODUCTS Not Used**

**PART 3 - EXECUTION Not Used**

**END OF SECTION**

**SECTION 01 4301****QUALITY ASSURANCE - QUALIFICATIONS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Related Documents:
  - 1. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Requirements:
  - 1. Section 01 4000: 'Quality Requirements' includes administrative and procedural requirements for quality assurance and quality control.
  - 2. Section 01 4523: 'Testing and Inspecting Services' for testing and inspection, and testing laboratory services for materials, products, and construction methods.

**1.2 REFERENCES**

- A. Definitions:
  - 1. Accreditation: Process in which certification of competency, authority, or credibility is presented. Verify that laboratories have an appropriate quality management system and can properly perform certain test methods (e.g., ANSI, ASTM, and ISO test methods) and calibration parameters according to their scopes of accreditation.
  - 2. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
  - 3. Testing Agency: Entity engaged to perform specific tests, inspections, or both.
  - 4. Testing Agency Laboratory: Agency or firm qualified to perform field and laboratory tests to determine characteristics and quality of materials and workmanship.
- B. Reference Standards:
  - 1. ASTM International:
    - a. ASTM E329-14a, 'Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.'

**1.3 QUALIFICATIONS**

- A. Qualifications: Qualifications paragraphs in this Article establish minimum qualification levels required; individual Specification Sections specify additional requirements:
  - 1. Fabricator / Supplier / Installer Qualifications: Firm experienced in producing products similar to those indicated for this Project and with record of successful in-service performance, as well as sufficient production capacity to produce required units.
    - a. VMR (Value Managed Relationship):
      - 1) Where heading '*VMR (Value Managed Relationship) / Manufacturers / Suppliers / Installers*' is used to identify list of specified suppliers or installers, Owner has established relationships that extend beyond requirements of this Project.
      - 2) No other *Suppliers / Installers* will be acceptable.
      - 3) Follow specified procedures to preserve relationships between Owner and specified suppliers / installers and advantages that accrue to Owner from those relationships.
      - 4) Following areas of the Work have restrictions on sub-bids by Contractor:
        - a) Architectural Woodwork, Section 06 4001: VMR, no other Fabricator accepted except approved Alternate Fabricator.
        - b) Asphalt Shingles, Section 07 3113: VMR, no other Manufacturer / Installers accepted.
        - c)

- d) Sheet Carpeting, Section 09 6816: VMR, no other Manufacturer / Installers accepted.
  - e) Wood-Grained Steel Doors And Frames, Section 08 1114: VMR Supplier, no other Supplier accepted.
- b. Approved:
- 1) Where heading '*Approved Suppliers / Distributors / Installers / Applicators / Fabricators*' is used to identify list of specified suppliers / distributors / installers / applicators / fabricators, use only listed suppliers / installers / fabricators.
  - 2) No substitutions will be allowed.
  - 3) Following areas of the Work have restrictions on sub-bids by which may be accepted by Contractor:
    - a) Electric And Electronic Control System for HVAC, Section 23 0933, No other Distributors accepted.
2. Factory-Authorized Service Representative Qualifications:
    - a. Authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
  3. Installer Qualifications:
    - a. Firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
  4. Manufacturer Qualifications:
    - a. Firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
  5. Manufacturer's Field Services Qualifications:
    - a. Experienced authorized representative of manufacturer to inspect field-assembled components and equipment installation, including service connections.
  6. Professional Engineer Qualifications:
    - a. Professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.
  7. Specialists:
    - a. Certain sections of Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations.
    - b. Specialists shall satisfy qualification requirements indicated and shall be engaged for activities indicated.
    - c. Requirement for specialists shall not supersede building codes and regulations governing the Work.
  8. Testing Agency Qualifications:
    - a. Independent Testing Agency with experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
      - 1) Testing Laboratory:
        - a) AASHTO Materials Reference Laboratory (AMRL) Accreditation Program.
        - b) Cement and Concrete Reference Laboratory (CCRL).
        - c) Nationally Recognized Testing Laboratory (NRTL): Nationally recognized testing laboratory according to 29 CFR 1910.7.
        - d) National Voluntary Laboratory (NVLAP): Testing Agency accredited according to National Institute of Standards and Technology (NIST) Technology Administration, U. S. Department of Commerce Accreditation Program.

**PART 2 - PRODUCTS Not Used**

**PART 3 - EXECUTION Not Used**

**END OF SECTION**

**SECTION 01 4523****TESTING AND INSPECTING SERVICES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section

**1.2 SUMMARY**

- A. This Section includes testing, inspections, special testing, special inspections, and testing laboratory services for materials, products, and construction methods as specified hereafter for the Work.
- B. Specified tests, inspections, and related actions do not limit Contractor's quality control procedures to fully comply with Contract Document requirements in all regards.
- C. Costs: Costs of initial services for testing and inspection personnel will be paid by Owner unless otherwise noted.
  - 1. If initial tests indicate non-compliance with contract document requirements, any subsequent testing will be performed by same personnel and paid for by Contractor.
- D. Related Requirements:
  - 1. Section 01 4000: 'Quality Requirements' includes administrative and procedural requirements for quality assurance and quality control.
  - 2. Section 01 4301: 'Quality Assurance – Qualifications' establishes minimum qualification levels required.
  - 3. Division 01 through Division 49 establish responsibility for providing specific testing and inspections and Field Tests and Inspections.

**1.3 REFERENCES**

- A. Association Publications:
  - 1. Council of American Structural Engineers. CASE Form 101: *Statement of Special Inspections*. Washington, DC: CASE, 2001. (c/o American Council of Engineering Companies, 1015 15<sup>th</sup> St., NW, Washington, DC 20005; 202-347-7474; [www.acec.org](http://www.acec.org)).
  - 2. International Code Council (IBC):
    - a. IBC Chapter 17, 'Structural Tests and Special Inspections'.
- B. Definitions:
  - 1. Accreditation: Process in which [certification](#) of competency, authority, or credibility is presented. Verify that laboratories have an appropriate quality management system and can properly perform certain test methods (e.g., ANSI, ASTM, and ISO test methods) and calibration parameters according to their scopes of accreditation.
  - 2. Approved: To authorize, endorse, validate, confirm, or agree to.
  - 3. Field Quality Control: Testing, Inspections, Special Testing and Special Inspections to assure compliance to Contract Documents.
  - 4. Inspection/Special Inspection:
    - a. Inspection: Not required by code provisions but may be required by Contract Documents.
    - b. Special Inspection: Inspection required of materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with approved construction documents and reference standards (required by code provisions and by Contract Documents).
    - c. Special Inspection-Continuous: Full-time observation of the Work requiring inspection by approved inspector who is present in area where the Work is being performed.



- d. Special Inspection-Periodic: Part-time or intermittent observation of the Work requiring inspection by approved inspector who is present in area where the Work has been or is being performed and at completion of the Work.
  5. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation. They are not samples. Approved mockups establish standard by which the Work will be judged.
  6. Observation: Visual observation of building / site elements or structural system by registered design professional for general conformance to approved construction documents at significant construction stages and at completion. Observation does not include or waive responsibility for performing inspections or special inspections.
  7. Preconstruction Testing: Tests and inspections that are performed specifically for Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
  8. Quality Assurance: Testing, Inspections, Special Testing and Special Inspections provided for by Owner.
  9. Quality Control: Testing, Inspections, Special Testing and Special Inspections provided for by Contractor.
  10. Special Inspection: See Inspection.
  11. Special Inspector: Certified individual or firm that implements special inspection program for project.
  12. Special Test: See Test.
  13. Test/Special Test: Field or laboratory tests to determine characteristics and quality of building materials and workmanship:
    - a. Test: Not required by code provisions but may be required by Contract Documents.
    - b. Special Test: Required by code provisions and by Contract Documents.
  14. Testing Agency: Entity engaged to perform specific tests, inspections, or both.
  15. Testing Agency Laboratory: Agency or firm qualified to perform field and laboratory tests to determine characteristics and quality of materials and workmanship.
  16. Verification: Act of reviewing, inspecting, testing, etc. to establish and document that product, service, or system meets regulatory, standard, or specification requirements.
- C. Reference Standards:
1. ASTM International:
    - a. ASTM A898/A898M-17, 'Standard Specification for Straight Beam Ultrasonic Examination of Rolled Steel Structural Shapes'.
    - b. ASTM C42/C42M-16, 'Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete'.
    - c. ASTM C138/C138M-17a, 'Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete'.
    - d. ASTM C597-16, 'Standard Test Method for Pulse Velocity Through Concrete'.
    - e. ASTM C803/C803M-17, 'Standard Test Method for Penetration Resistance of Hardened Concrete'.
    - f. ASTM C805/C805M-13a, 'Standard Test Method for Rebound Number of Hardened Concrete'.
    - g. ASTM C1019-16, 'Standard Test Method for Sampling and Testing Grout'.
    - h. ASTM C1021-08(2014), 'Standard Practice for Laboratories Engaged in Testing of Building Sealants'.
    - i. ASTM C1077-16a, 'Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation'.
    - j. ASTM C1093-15a, 'Standard Practice for Accreditation of Testing Agencies for Masonry'.
    - k. ASTM D3666-16, 'Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials'.
    - l. ASTM D3740-12a, 'Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction'.
    - m. ASTM E114-15, 'Standard Practice for Ultrasonic Pulse-Echo Straight-Beam Examination by the Contact Method'.

- n. ASTM E164-13, 'Standard Practice for Contact Ultrasonic Testing of Weldments'.
- o. ASTM E329-14a: 'Standard Specification for Agencies Engaged in Construction Inspection and/or Testing'.
- p. ASTM E488-15, 'Standard Test Methods for Strength of Anchors in Concrete Elements'.
- q. ASTM E543-15, 'Standard Specification for Agencies Performing Nondestructive Testing'.
- r. ASTM E587-15, 'Standard Practice for Ultrasonic Angle-Beam Examination by the Contact Method'.
- s. ASTM E709-15, 'Standard Guide for Magnetic Particle Testing'.
- t. ASTM E1212-17, 'Standard Practice for Quality Management Systems for Nondestructive Testing Agencies'.
- u. ASTM F710-11, 'Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring'.
- v. ASTM F2170-16b, 'Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes'.
- 2. Code of Federal Regulations:
  - a. 29 CFR 1910, Subpart A, Section 1910.7, 'Definition and Requirements for a Nationally Recognized Testing Laboratory'.
- 3. International Code Council (IBC 2015 or latest approved edition):
  - a. IBC Chapter 17, 'Special Inspections And Tests'.
    - 1) Section 1704, 'Special Inspections And Tests, Contractor Responsibility And Structural Observations'.
    - 2) Section 1705, 'Required Special Inspection And Tests'.
      - a) Section 1705.2, 'Steel Construction'.

#### 1.4 SUBMITTALS

- A. Informational Submittals:
  - 1. General: Additional submittal requirements are specified in Individual Sections in Division 01 through Division 50.
  - 2. Certificates:
    - a. Testing Agency will submit certified written report of each inspection, test, or similar service.
  - 3. Tests and Evaluation Reports:
    - a. Testing Agency or Agencies will prepare logs, test reports, and certificates applicable to specific tests and inspections and deliver copies (or electronic record) distributed as follows:
      - 1) 1 copy to Owner's Representative.
      - 2) 1 copy to Architect.
      - 3) 1 copy to Consulting Engineers (Engineer of Record).
      - 4) 1 copy to General Contractor.
      - 5) 1 copy to Authorities Having Jurisdiction (if required).
    - b. Other tests, certificates, and similar documents will be obtained by Contractor and delivered to Owner's Representative and Architect in such time as not to delay progress of the Work or final payment therefore.
    - c. Submittal Format:
      - 1) Schedule of Tests and Inspections: Prepare in tabular form and include following:
        - a) Specification Section number and title.
        - b) Description of test and inspection.
        - c) Identification of applicable standards.
        - d) Identification of test and inspection methods.
        - e) Number of tests and inspections required.
        - f) Time schedule or time span for tests and inspections.
        - g) Entity responsible for performing tests and inspections.
        - h) Requirements for obtaining samples.
      - 2) Certified written reports of each inspection, test, or similar service will include, but not be limited:
        - a) Date of issue.
        - b) Project title 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 and inspections.

- f) Description of the Work and test and inspection method.
  - g) Identification of product and Specification Section.
  - h) Complete test or inspection data.
  - i) Test and inspection results and an interpretation of test results.
  - j) Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  - k) Comments or professional opinion on whether tested or inspected Work complies with Contract Document requirements.
  - l) Name and signature of laboratory inspector.
  - m) Recommendations on retesting and re-inspecting.
4. Source Quality Control Submittals:
- a. Testing Agency will submit following prior to commencing the Work:
    - 1) Qualifications of Testing Agency management and personnel designated to project.
    - 2) Testing Agency 'Written Practice for Quality Assurance'.
    - 3) Qualification records for Inspector and non-destructive testing technicians designated for project.
    - 4) Testing Agency non-destructive testing procedures, equipment calibration records, and personnel training records.
    - 5) Testing Agency Quality Control Plan for monitoring and control of testing operations.
    - 6) Welding Inspection Procedures (Structural Steel testing).
    - 7) Bolting Inspection Procedures (Structural Steel testing).
    - 8) Shear Connector Stud Inspection Procedures (Structural Steel testing).
    - 9) Seismic Connections Inspection Procedures (Structural Steel testing).

## 1.5 QUALITY ASSURANCE

- A. Owner or Owner's designated representative(s) will perform quality assurance. Owner's quality assurance procedures may include observations, inspections, testing, verification, monitoring and any other procedures deemed necessary by Owner to verify compliance with Contract Documents.
- B. Owner will employ independent Testing Agencies to perform certain specified testing, as Owner deems necessary.
- C. Certification:
  - 1. Product producers and associations, which have instituted approved systems of quality control and which have been approved by document approval agencies, are not required to have further testing.
  - 2. Concrete mixing plants, plants producing fabricated concrete and wood or plywood products certified by agency, lumber, plywood grade marked by approved associates, and materials or equipment bearing underwriters' laboratory labels require no further testing and inspection.
- D. Written Practice for Quality Assurance:
  - 1. Testing Agency will maintain written practice for selection and administration of inspection personnel, describing training, experience, and examination requirements for qualification and certification of inspection personnel.
  - 2. Written practice will describe testing agency procedures for determining acceptability of structure in accordance with applicable codes, standards, and specifications.
  - 3. Written practice will describe Testing Agency inspection procedures, including general inspection, material controls, visual welding inspection, and bolting inspection.

## 1.6 QUALITY CONTROL

- A. Quality Control will be sole responsibility of Contractor. Contractor will be responsible for testing and inspections, coordination, start-up, operational checkout, and commissioning of all items of the Work included in Project. All costs for these services will be included in Contractor's cost of the Work.

- B. Contractor will assign one (1) employee to be responsible for Quality Control. This individual may have other responsibilities and may be Contractor's Project superintendent or Contractor's Project Manager.
- C. Notify results of all Testing and Inspection performed by Contractor's independent Testing Agencies to Architect and Owner's Representative within twenty four (24) hours of test or inspection having been performed.
1. Testing and Inspection Reports will be distributed as follows:
    - a. 1 copy to Owner's Representative.
    - b. 1 copy to Architect.
    - c. 1 copy to Consulting Engineer(s) (Engineer of Record).
    - d. 1 copy to Authorities Having Jurisdiction (if required).
- D. Contractor's Responsibility:
1. Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform the Work in strict accordance with requirements of Contract Documents.
  2. Tests and inspections that are not explicitly assigned to Owner are responsibility of Contractor.
  3. Cooperate with Testing Agency(s) performing required inspections, tests, and similar services and provide reasonable auxiliary services as requested. Notify Testing Agency before operations to allow assignment of personnel. Auxiliary services required include but are not limited to:
    - a. Providing access to the Work and furnishing incidental labor, equipment, and facilities deemed necessary by Testing Agency to facilitate inspections and tests at no additional cost to Owner.
    - b. Taking adequate quantities of representative samples of materials that require testing or helping Testing Agency in taking samples.
    - c. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
    - d. Providing Testing Agency with preliminary design mix proposed for use for materials mixes that require control by Testing Agency.
  4. Contractor will integrate Owner's independent Testing Agency services within Baseline Project Schedule and with other Project activities.
  5. For any requested inspection, Contractor will complete prior inspections to ensure that items are ready for inspection.
  6. All Work is subject to testing and inspection and verification of correct operation prior to 100% payment to Contractor of line item(s) pertaining to that aspect of the Work.
  7. For Mechanical Equipment, inspection and documented approval of individual equipment and/or system(s) must be accomplished prior to requesting Substantial Completion Inspection for any area affected by said equipment and/or system:
    - a. Contractor will perform thorough checkout of operations with manufacturer's representatives prior to requesting formal inspection by Owner.
    - b. Contractor must notify Owner's Representative, in advance, as to when manufacturer's representative is scheduled to arrive at Site.
  8. Comply:
    - a. Upon completion of Testing Agency's inspection, testing, sample-taking, and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.
    - b. Comply with Contract Documents in making such repairs.
  9. Data: Furnish records, drawings, certificates, and similar data as may be required by testing and inspection personnel to assure compliance with Contract Documents.
  10. Defective Work (Non-Conforming Work): Non-conforming Work as covered in General Conditions applies, but is not limited to following requirements:
    - a. Where results of inspections, tests, or similar services show that the Work does not comply with Contract Document requirements, correct deficiencies in the Work promptly to avoid Work delays.
    - b. Where testing personnel take cores or cut-outs to verify compliance, repair prior to acceptance.
    - c. Contractor responsible for any and all costs incurred resulting from inspection that was scheduled prematurely or retesting due to failed tests.

- d. Remove and replace any Work found defective or not complying with contract document requirements at no additional cost to Owner.
- e. Should test return unacceptable results, Contractor will bear all costs of retesting and re-inspection as well as cost of all material consumed by testing, and replacement of unsatisfactory material and/or workmanship.
- 11. Protection:
  - a. Protect construction exposed by or for quality assurance and quality control service activities, and protect repaired construction.
- 12. Scheduling: Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities:
  - a. Schedule testing and inspections in advance so as not to delay the Work and to eliminate any need to uncover Work for testing or inspection.
  - b. Notify Testing Agency and Architect as noted in Sections in Division 01 through Division 50 prior to any time required for such services.
  - c. Incorporate adequate time for performance of all inspections and correction of noted deficiencies.
  - d. Schedule sequence of activities to accommodate required services with minimum of delay.
  - e. Schedule sequence of activities to avoid necessity of removing and replacing construction to accommodate testing and inspections
- 13. Test and Inspection Log:
  - a. Provide system of tracking all field reports, describing items noted, and resolution of each item. Prepare record of tests and inspections. Include following:
    - 1) Date test or inspection was conducted.
    - 2) Description of the Work tested or inspected.
    - 3) Date test or inspection results were transmitted to Architect.
    - 4) Identification of Testing Agency or inspector conducting test or inspection.
  - b. Maintain log at Project site:
    - 1) Post changes and modifications as they occur.
    - 2) Provide access to test and inspection log for Architect's reference during normal working hours.

## 1.7 TESTING AND INSPECTIONS - GENERAL

- A. Testing specifically identified to be conducted by Owner, will be performed by an independent entity and will be arranged and paid for by Owner.
- B. Individual Sections in Division 01 through Division 49 indicate if Owner will provide testing and inspection of the Work of that Section.
- C. Tests include but not limited to those described in detail in 'Field Quality Control' in Part 3 of Individual Sections in Divisions 01 through Division 49.
- D. Owner may engage additional consultants for testing, air balancing, commissioning, or other special services:
  - 1. Activities of any such Owner consultants are in addition to Contractor testing of materials or systems necessary to prove that performance is in compliance with Contract requirements.
  - 2. Contractor must cooperate with persons and firms engaged in these activities.
- E. Taking Specimens:
  - 1. Except as may be specifically otherwise approved by Architect, only testing laboratory shall secure, handle, transport, or store any samples and specimens for testing.
- F. Scheduling Testing Agency:
  - 1. Contractor will coordinate the Work and facilitate timeliness of such testing and inspecting services so as not to delay the Work.
  - 2. Contractor will notify Testing Agency and Architect to schedule tests and / or inspections.

- G. For 'building-wide' and/or life safety systems, such as emergency lighting, emergency power uninterruptible power supply systems, fire alarm, fire sprinkler systems, smoke evacuation systems, toxic gas monitoring, capturer exhaust systems, etc. formal start-up inspection will be completed prior to requesting Substantial Completion Inspection for any area of Project:
1. Manufacturer's representatives and installing contractor will demonstrate both operation and compliance to Owner's agents and consultants. If coordinated and scheduled appropriately by Contractor, these equipment and/or systems inspections may also serve to provide required Owner training, if approved in advance by Owner.
  2. Contractor responsible for requesting that Architect arrange for inspection of materials, equipment, and work prior to assembly or enclosure that would make materials, equipment, or work inaccessible for inspection and at other times as may be required.

## 1.8 TESTING AGENCY SERVICES AND RESPONSIBILITIES

- A. Testing Agency, including independent testing laboratories, will be licensed and authorized to operate in jurisdiction in which Project is located.
1. Approved Testing Agency Qualifications: Requirements of Section 01 4301 apply.
- B. Testing and Inspection Services:
1. Testing Agency will not release, revoke, alter, or increase Contract Document requirements or approve or accept any portion of the Work.
  2. Testing Agency will not give direction or instruction to Contractor.
  3. Testing Agency will have full authority to see that the Work is performed in strict accordance with requirements of Contract Documents and directions of Owner's Representative and/or Architect.
  4. Testing Agency will not provide additional testing and inspection services beyond scope of Work without prior approval of Owner's Representative and / or Architect.
- C. Testing Agency Duties:
1. Independent Testing Agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual specification Sections will cooperate with Architect and Contractor in performance of its duties and will provide qualified personnel to perform required inspections and tests.
  2. Testing Agency will test or obtain certificates of tests of materials and methods of construction, as described herein or elsewhere in technical specification.
  3. Testing Agency will provide management, personnel, equipment, and services necessary to perform testing functions as outlined in this section.
  4. Testing Agency must have experience and capability to conduct testing and inspecting indicated by ASTM standards and that specializes in types of tests and inspections to be performed.
  5. Testing Agency will comply with requirements of ASTM E329, ASTM E543, ASTM C1021, ASTM C1077, ASTM C1093, ASTM D3666, ASTM D3740, and other relevant ASTM standards.
  6. Testing Agency must calibrate all testing equipment at reasonable intervals (minimum yearly) with accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.
  7. Welding Procedure Review: Testing Agency will provide review and approval or rejection of all welding procedures to be used and will verify compliance with all reference standard requirements.
- D. Testing and Inspection Reports:
1. Conduct and interpret tests and inspections and state in each report whether tested and inspected the Work complies with or deviates from requirements.
  2. Inspection Reports:
    - a. Testing Agency will furnish 'Inspection at Site' reports for each site visit documenting activities, observations, and inspections.
    - b. Include notation of weather and climatic conditions, time and date conditions and status of the Work, actions taken, and recommendations or evaluation of the Work.
  3. Reporting Testing and Inspection (Conforming Work):
    - a. Submit testing and inspection reports as required within twenty four (24) hours of test or inspection having been performed.
  4. Reporting Testing and Inspection Defective Work (Non-Conforming Work):

- a. Testing Agency, upon determination of irregularities, deficiencies observed or test failure(s) observed in the Work during performance of its services of test or inspection having been performed, will:
    - 1) Verbally notify results to Architect, Contractor, and Owner's Representative within one hour of test or inspection having been performed (if Defective Work (Non-Conforming Work) is incorporated into project).
    - 2) Submit written inspection report and test results as required within twenty four (24) hours of test or inspection having been performed.
  - b. Prepare non-compliance log to track non-compliant testing or inspections.
5. Final Report:
- a. Submit final report of tests and inspections at Substantial Completion, which identify unresolved deficiencies.

## **PART 2 - PRODUCTS Not Used**

## **PART 3 - EXECUTION**

### **3.1 FIELD QUALITY CONTROL**

- A. Field Tests And Inspections:
  1. Field Tests and Inspections requirements are described in 'Field Quality Control' of individual Sections in Division 01 through Division 49.

**END OF SECTION**

**SECTION 01 4546****DUCT TESTING, ADJUSTING, AND BALANCING****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Is Not Limited To:
  - 1. Test, balance, and adjust air duct systems services provided by Owner as described in Contract Documents.
- B. Related Requirements:
  - 1. Section 01 1200: 'Multiple Contracts Summary': Owner will provide test, balance, and adjust air duct systems. PART 3 of this Section establishes requirements for field tests of 'Testing Agency'.
  - 2. Section 01 4523: 'Testing and Inspecting Services' for testing and inspection, and testing laboratory services for materials, products, and construction methods.
  - 3. Division 23:
    - a. Completing installation and start-up of mechanical systems, and changing sheaves, belts, and dampers as required for correct balance.
    - b. Maintain HVAC system and equipment in full operation each working day of testing, balancing, and adjusting.
- C. Related Requirements:
  - 1. Section 01 0000: 'General Requirements':
    - a. Section 01 1200: 'Multiple Contracts Summary': Owner will provide test, balance, and adjust air duct systems. PART 3 of this Section establishes requirements for field tests of 'Testing Agency'.
    - b. Section 01 4523: 'Testing and Inspecting Services' for testing and inspection, and testing laboratory services for materials, products, and construction methods.
  - 2. Division 23:
    - a. Completing installation and start-up of mechanical systems, and changing sheaves, belts, and dampers as required for correct balance.
    - b. Maintain HVAC system and equipment in full operation each working day of testing, balancing, and adjusting.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Contractor to assist Testing Agency in testing and balancing of mechanical system.
- B. Scheduling:
  - 1. Contractor to schedule this work in cooperation with other Sections involved and to comply with completion date for test, balance, and adjust air duct systems as described in Contract Documents.
  - 2. Contact Testing Agency and coordinate (Owner' Representative to provide 'Testing Agency' contact information):
    - a. One inspection when 60 percent of ductwork is installed.
    - b. One inspection when 90 percent of equipment and ductwork is installed.
  - 3. Contact Testing Agency and coordinate date(s) for test and balance work when following is completed:
    - a. HVAC and exhaust systems including installation of specialties, devices, and new filters.
    - b. Proper function of control system components including electrical interlocks, damper sequences, air and water reset, and fire and freeze stats has been verified.
    - c. Automatic temperature controls have been calibrated and set for design operating conditions.



- d. Verification of proper thermostat calibration and setting of control components such as static pressure controllers and other devices that may need set points changed during process of balancing system.
4. If, in opinion of Testing Agency, systems are not ready for test and balance, reschedule as required.

### 1.3 SUBMITTALS

- A. Informational Submittals:
  1. Test and Evaluation Reports:
    - a. Preliminary Report(s):
      - 1) Four copies to be given to Owner's Representative.
    - b. Final Report :
      - 1) Four copies to be given to Owner's Representative.
- B. Closeout Submittals:
  1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    - a. Record Documentation:
      - 1) Testing and Inspection Reports:
        - a) Testing Agency Testing and Evaluation Final Report of testing, balancing, and adjusting air duct systems. Bind approved copy of Testing and Evaluation Report in Operations And Maintenance Manual for Division 23.

### 1.4 QUALITY ASSURANCE

- A. Qualifications:
  1. Approved Testing Agency. Section 01 4301 applies, but is not limited to following:
    - a. Testing Agency shall specialize in testing and balancing of heating, ventilating, and cooling systems to balance, adjust, and test air moving equipment, air distribution, and exhaust systems.
    - b. Testing Agency shall provide proof of having successfully completed at least five years of specialized experience in air and hydronic system balancing.
    - c. Testing Agency shall provide testing under direct supervision of qualified heating and ventilating engineer.
    - d. Neither Architect's engineering consultant nor anyone performing work on this Project under other Sections of Division 23 shall be permitted to do this work.

### PART 2 - PRODUCTS: Not Used

### PART 3 - EXECUTION

#### 3.1 OWNER-FURNISHED TESTING AND INSPECTION

- A. Owner to provide Testing and Inspection for testing, balancing, and adjusting air duct systems:
  1. See Section 01 1200: Multiple contracts for administrative and procedural requirements for Testing and Inspection services.

#### 3.2 FIELD QUALITY CONTROL

- A. Field Tests
  1. Air System Testing, Adjusting, And Balance:
    - a. Inspections and site visits. (For paragraph a thru c, note deficiencies, if any, that needs to be corrected and report this to Owner's Representative, Architect, and Mechanical Engineer):
      - 1) One inspection when ductwork installation is 60 percent complete.
      - 2) One inspection when ductwork is installation is 90 percent complete.
      - 3) One inspection when potable hot and cold water system is 90 percent complete.
      - 4) Site visit for test and balance. Before commencing test and balance, perform an inspection to verify 100 percent completion of system. Confirm completion of work,

- correction of previously noted deficiencies, and look for new deficiencies not noted in previous inspections. If the work is complete, then proceed with test and balance. If the work is not complete and ready for test and balance, inform Contractor and submit an invoice to Owner's Representative for compensation for travel time, expenses, and time on site. Report deficiencies or incomplete work to Owner's Representative, Architect, and Mechanical Engineer.
- 5) Additional site visits (beyond those set forth above) to complete the work after issues are resolved may be needed and will be paid for separately from compensation for services set forth in this Agreement, pursuant to hourly rates and conditions set forth in Attachment "A".
- b. Checklist for Inspections and site visits:
- 1) Pre-Startup Inspection – use for inspections and site visits a thru d in paragraph 1 above. All pertinent items shall be checked, including but not limited to following:
    - a) Removal of shipping blocks and stops.
    - b) Vibration isolators' alignment and adjustment.
    - c) Flexible connections properly installed and aligned.
    - d) Safety controls, safety valves and high or low limits in operation.
    - e) All systems properly filled.
    - f) Filters in place and seal provided around edges.
    - g) Filters and strainers are clean.
    - h) Fire damper installation and operation, and access door installation.
    - i) Installation of all gauges on equipment.
    - j) Control system is operating.
    - k) All dampers, valves, and operators are properly installed and operating.
    - l) All ductwork is installed and sealed.
    - m) Voltage to unit matches nameplate voltage.
  - 2) First Run Inspection – use for inspections and site visits d and e in paragraph 1 above. Recheck items in Pre-Startup list, and check for following items:
    - a) Excessive vibration or noise.
    - b) Loose components.
    - c) Initial control settings.
    - d) Motor amperages.
    - e) Heat buildup in motors.
    - f) Control system is calibrated and functioning as required.
  - 3) System Operation Inspection – use for inspections and site visits d and e in paragraph 1 above. Observe mechanical systems under operation for sufficient amount of time to ensure proper operation in all running modes. Check following items periodically.
    - a) Filters and strainers.
    - b) Filters and strainers.
    - c) Check for system leaks at seals and valves.
- c. Performance Requirements:
- 1) Testing and balancing in complete accordance with Associated Air Balance Council (AABC) Standards for Field Measurement & Instructions, Form P1266, Volume I.
  - 2) Noise level in chapel and / or cultural hall shall not exceed NC 35 with all HVAC equipment operating in full or second stage cooling mode.
- d. Site tests: Air Test and Balancing Procedure:
- 1) Instruments used by Consultant shall be accurately calibrated and maintained in good working order.
  - 2) All supply air and return air fans in all HVAC zone systems, energy recovery ventilators, and exhaust fans in building shall be operating when final setup of all units is performed.
  - 3) Perform tests at high and low speeds of multi-speed systems and single speed systems.
  - 4) Perform following testing and balancing functions in accordance with Associated Air Balance Council National Standards.
    - a) Fan Speeds - Air handling units (with variable pitch pulleys and sheaves): Test and adjust fan RPM to achieve design CFM requirements.
    - b) Fan Speeds - Furnaces (with direct drive motors): Set fan speed to lowest possible setting that will achieve design CFM requirements. Adjust down from

- Contractor setting, if necessary. Adjust low voltage fan speed jumpers (provided and installed by contractor) as necessary to achieve design cooling air flow at lowest possible setting. An exception to this would be when furnace is variable speed blower for dehumidification applications.
- c) Current And Voltage: Measure and record motor current and voltage.
  - d) Pitot-Tube Traverse Method:
    - (1) Make measurements in duct where velocity is uniform, 7-1/2 duct diameters downstream and 2 duct diameters minimum upstream from any turbulence, i.e., elbow, damper, take-off, etc.
    - (2) Perform pitot-tube traverse of outdoor ventilation air duct serving each piece of air moving equipment.
    - (3) Where single outdoor ventilation air trunk duct serves multiple pieces of equipment, perform pitot-tube traverse of duct branch serving each piece of equipment as well as pitot-tube traverse of total air flow in trunk with all pieces of equipment operating.
  - e) Where pitot-tube traverse is not possible or if pitot-tube traverse is unreliable, flow hood measurement over exterior intake louver or grille is acceptable for measuring outdoor ventilation air.
  - f) Use proportionate method of air balance leaving fan at lowest possible speed and at least one branch balance damper fully open.
- 5) Static Pressure: Test and record system static pressures, including suction and discharge static pressure of each fan.
  - 6) Air Temperature: Take dry bulb air temperatures on entering and leaving side of each cooling coil. Dry bulb temperatures shall be taken on entering and leaving side of each heating unit.
  - 7) Zone Ducts: Adjust zone ducts to within design CFM requirements. At least one zone balancing damper shall be completely open.
  - 8) Branch Ducts: Adjust branch ducts to within design CFM requirements. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.
  - 9) Tolerances: Test and balance all fans, zone ducts, registers, diffusers etc. to + or – 10 percent of design CFM.
  - 10) Identification: Identify location and area of each grille, diffuser, register, and terminal box. Record on air outlet data sheets.
  - 11) Description: Record size, type, and manufacturer of each diffuser, grille, and register on air outlet data sheets.
  - 12) Drafts: Adjust diffusers, grilles, and registers to minimize drafts. For high sidewall supply air diffusers install horizontal blade core to direct air flow upward 15 degree and set adjustable vertical blades to spread air flow horizontally and evenly in fan pattern.
  - 13) Permanently mark all outside air, supply air, and return air damper positions after balancing has been completed.
  - 14) Smoke testing: Smoke testing, or some other approved means, may be required to determine leak locations if air balance report indicates that any system's CFM total is less than 90 percent of design CFM. Prior to test, verify that system's duct joints have been sealed as specified and that air moving device in question is supplying required design system air flow. Mechanical Engineer will approve test method required. If smoke test is selected, use following procedure. Provide necessary precautions to protect those performing or observing test from being exposed to smoke.
    - a) Use zinc chloride smoke candles, titanium tetrachloride ampules or sticks, or other devices acceptable to Mechanical engineer to generate smoke.
    - b) Close openings in duct except for one opening at farthest end of duct run.
    - c) Circulate smoke at pressurized condition of **1/2 inch (13 mm)** minimum water gauge static pressure.
    - d) Report findings to mechanical engineer in writing.
- e. Air System Test and Evaluation Report:
- 1) Record test data on AABC standard forms or facsimile.
  - 2) Preliminary Report: Provide and deliver four copies of complete data for evaluation and approval to Owner.
  - 3) Final report: Provide and deliver complete four copies of final report to Owner prior to project Substantial Completion date.

- 4) Complete with logs, data, and records as required herein. Print logs, data, and records on white bond paper bound together in report form.
- 5) Certified accurate and complete by Consultant's certified test and balance engineer.
- 6) Contain following general data in format selected by Consultant:
  - a) Project Number.
  - b) Project Title.
  - c) Project Location.
  - d) Project Architect and Mechanical Engineer.
  - e) Consultant and Certified Engineer.
  - f) Contractor and mechanical sub-contractor.
  - g) Dates tests were performed.
  - h) Certification Document.
  - i) Report Forms similar to AABC Standard format.
- 7) Report shall include following:
  - a) Instrumentation List including type, model, manufacturer, serial number, and calibration dates.
  - b) HVAC zone identification to include reduced ductwork floor plan from project documents with outlets and inlets numbered to match written test and balance report. This page may be oversized but it should fold up neatly within standard 8 1/2 x 11 report paper size.
  - c) Record following for each piece of air handling equipment:
    - (1) Manufacturer, model number, and serial number.
    - (2) Design and manufacture rated data.
    - (3) Actual CFM.
    - (4) Suction and discharge static pressure of each fan.
    - (5) Outdoor-ventilation-air and return-air total CFM.
    - (6) Final RPM of each motor or speed tap.
    - (7) Actual operating current and voltage of each fan motor.
    - (8) Fan and motor sheave manufacturer, model, size, number of grooves and center distance.
    - (9) Belt size and quantity.

### 3.3 PREPARATION

- A. Heating, ventilating, and cooling systems and equipment shall be in full operation and continue in operation during each working day of testing and balancing.

**END OF SECTION**

**SECTION 01 5600****TEMPORARY BARRIERS AND ENCLOSURES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes But is Not Limited To:
  - 1. Administrative and procedural requirements for Temporary Barriers and Enclosures.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- A. Protection Of Adjacent Property: Provide necessary protection for adjacent property and lateral support thereof.

**1.3 TEMPORARY DUST BARRIERS**

- A. Provide Visqueen barriers to section off work areas from the rest of the building
- B. Cover and protect carpet, furniture, artwork, etc. that must remain in construction area.

**1.4 TEMPORARY NOISE BARRIERS**

- A.

**1.5 TEMPORARY BARRICADES**

- A. Comply with standards and code requirements in erecting barricades, warning signs, and lights.
- B. Take necessary precautions to protect persons, including members of the public, from injury or harm.

**PART 2 - PRODUCTS Not Used****PART 3 - EXECUTION Not Used****END OF SECTION**

**SECTION 01 5700****TEMPORARY CONTROLS****PART 1 - GENERAL****1.1 SUMMARY**

A. Section Includes But is Not Limited To:

1. Administrative and procedural requirements for Temporary Controls.

**1.2 TEMPORARY ENVIRONMENTAL CONTROLS**

A. Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and reduce possibility that air, waterways, and subsoil might be contaminated or polluted, or that other undesirable effects might result:

1. Avoid use of tools and equipment that produce harmful noise.
2. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near site.

B. Provide protection against weather (rain, winds, storms, frost, or heat) to maintain all work, materials, apparatus, and fixtures free from injury or damage.

**PART 2 - PRODUCTS Not Used****PART 3 - EXECUTION Not Used****END OF SECTION**

**SECTION 01 6100****COMMON PRODUCT REQUIREMENTS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes But is Not Limited To:
1. Administrative and procedural requirements for Common Product Requirements.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- A. Provide products that comply with Contract Documents, that are undamaged, and, unless otherwise indicated, new and unused at time of installation. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for complete installation and for intended use and effect.
- B. Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on surfaces of products that will be exposed to view in occupied spaces or on building exterior.
1. Locate required product labels and stamps on concealed surface or, where required for observation after installation, on accessible surface that is not conspicuous.
  2. Provide permanent nameplates on items of service-connected or power-operated equipment. Locate on easily accessible surface that is inconspicuous in occupied spaces. Nameplate will contain following information and other essential operating data:
    - a. Name of product and manufacturer.
    - b. Model and serial number.
    - c. Capacity.
    - d. Speed.
    - e. Ratings.
- C. Where specifications describe a product or assembly by specifying exact characteristics required, with or without use of brand or trade name, provide product or assembly that provides specified characteristics and otherwise complies with Contract requirements.
- D. Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by manufacturer for application described. General overall performance of product is implied where product is specified for specific application. Manufacturer's recommendations may be contained in published product literature, or by manufacturer's certification of performance.
- E. Where specifications only require compliance with an imposed code, standard, or regulation, select product that complies with standards, codes or regulations specified.
- F. Where Specifications require matching an established Sample, Architect's decision will be final on whether proposed product matches satisfactorily. Where no product available within specified category matches satisfactorily nor complies with other specified requirements, refer to Architect.
- G. Where specified product requirements include phrase ` . . . as selected from manufacturer's standard colors, patterns, textures . . . ' or similar phrase, select product and manufacturer that comply with other specified requirements. Architect will select color, pattern, and texture from product line selected.
- H. Refer to individual Specification Sections and Allowance provisions in Division 01 for allowances that control product selection, and for procedures required for processing such selections.

- I. Remove and replace products and materials not specified in Contract Documents but installed in the Work with specified products and materials at no additional cost to Owner and for no increase in Contract time.
- J. Informational Submittals:
  - 1. Sustainable Design Submittals:
    - a. Submit five copies of each required submittal unless otherwise required. Architect will return three copies marked with action taken and with corrections or modifications required.
    - b. Submit electronic files: PDF. Architect will return a PDF copy marked with action taken and with corrections or modifications required.

**PART 2 - PRODUCTS Not Used**

**PART 3 - EXECUTION Not Used**

**END OF SECTION**



**SECTION 01 6200****PRODUCT OPTIONS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes But is Not Limited To:
1. Administrative and procedural requirements for Product Options.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- A. Product Selection:
1. When option of selecting between two or more products is given, product selected will be compatible with products previously selected, even if previously selected products were also options.
    - a. Regional materials.
- B. Non-Conforming Work:
1. Non-conforming work as covered in Article 12.3 of General Conditions applies, but is not limited, to use of non-specified products or manufacturers.
- C. Product selection is governed by Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include:
1. Substitutions And Equal Products:
    - a. Generally speaking, substitutions for specified products and systems, as defined in the Uniform Commercial Code, are not acceptable. However, equal products may be approved upon compliance with Contract Document requirements.
    - b. Approved Products / Manufacturers / Suppliers / Distributors / Fabricators / Installers:
      - 1) Category One:
        - a) Owner has established 'Relationships' that extend beyond requirements of this Project. No substitutions or equal products will be allowed on this Project.
        - b) Specification Sections specify Owner Furnished and Owner Installed Manufacturers or Products.
        - c) Follow specified procedures to preserve relationships between Owner and specified manufacturers / suppliers and advantages that accrue to Owner from those relationships.
      - 2) Category Two:
        - a) Owner has established 'Relationships' that contain provisions extending beyond requirements of this Project. No substitutions or equal products will be allowed on this Project.
        - b) Specification Sections specify Owner Furnished and Contractor Installed Manufacturers, Suppliers, Distributors or Products.
        - c) Follow specified procedures to preserve relationships between Owner and specified manufacturers / suppliers and advantages that accrue to Owner from those relationships.
      - 3) Category Three:
        - a) Owner has established 'Relationships' that contain provisions extending beyond requirements of this Project. Use these products to preserve advantages that accrue to Owner from those programs. No substitutions or equal products will be allowed on this Project.
        - b) Specification Sections specify Contractor Furnished and Contractor Installed Manufacturers, Suppliers, Distributors, Fabricators or Products.
      - 4) Category Four:

- a) Provide only specified products available from manufacturers listed. No substitutions, private-labeled, or equal products, or mixing of manufacturers' products is allowed on this Project.
- b) In Sections where lists recapitulating Manufacturers previously mentioned in Section are included under heading '*Manufacturers*' or '*Approved Manufacturers*', this is intended as a convenience to Contractor as a listing of contact information only. It is not intended that all manufacturers in list may provide products where specific products and manufacturers are listed elsewhere in Section.
- c. Acceptable Products / Manufacturers / Suppliers / Installers:
  - 1) Type One: Use specified products / manufacturers unless approval to use other products / manufacturers has been obtained from Architect by Addendum.
  - 2) Type Two: Use specified products / manufacturers unless approval to use other products and manufacturers has been obtained from Architect in writing before installing or applying unlisted or private-labeled products.
  - 3) Use 'Equal Product Approval Request Form' to request approval of equal products, manufacturers, or suppliers before bidding or before installation, as noted in individual Sections.
- d. Quality / Performance Standard Products / Manufacturers:
  - 1) Class One: Use specified product / manufacturer or equal product from specified manufacturers only.
  - 2) Class Two: Use specified product / manufacturer or equal product from any manufacturer.
  - 3) Products / manufacturers used shall conform to Contract Document requirements.

**PART 2 - PRODUCTS Not Used**

**PART 3 - EXECUTION Not Used**

**END OF SECTION**

**SECTION 01 6600****PRODUCT DELIVERY, STORAGE, AND HANDLING REQUIREMENTS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes But is Not Limited To:
  - 1. Administrative and procedural requirements for Product Delivery, Storage, and Handling Requirements.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- A. Deliver, store, and handle products according to manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.

**1.3 DELIVERY AND ACCEPTANCE REQUIREMENTS**

- A. Schedule delivery to reduce long-term storage at site and to prevent overcrowding of construction spaces.
- B. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
- C. Deliver products to site in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
- D. Inspect products upon delivery to ensure compliance with Contract Documents, and to ensure that products are undamaged and properly protected.

**1.4 STORAGE AND HANDLING REQUIREMENTS**

- A. Store products at site in manner that will simplify inspection and measurement of quantity or counting of units.
- B. Store heavy materials away from Project structure so supporting construction will not be endangered.
- C. Store products subject to damage by elements above ground, under cover in weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

**PART 2 - PRODUCTS Not Used****PART 3 - EXECUTION Not Used****END OF SECTION**

**SECTION 01 7100**

**EXAMINATION AND PREPARATION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes But is Not Limited To:
  - 1. Administrative and procedural for Examination And Preparation of the Work.

**PART 2 - PRODUCTS: Not Used**

**PART 3 - EXECUTION**

**3.1 FIELD ENGINEERING**

- A. Construction Layout:
  - 1. Stake location and elevations of:
    - a. Utility / mechanical pads.
    - b. Miscellaneous Cast-in-Place Concrete elements.

**3.2 PROTECTION OF ADJACENT CONSTRUCTION**

- A. Protect adjacent properties and constructions.

**END OF SECTION**

**SECTION 01 7300****EXECUTION****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes But is Not Limited To:
1. Administrative and procedural requirements for governing Execution of the Work.

**1.2 COMMON INSTALLATION PROVISIONS**

- A. Manufacturer's Instructions: Comply with Manufacturer's installation instructions and recommendations to extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents. Notify Architect of conflicts between Manufacturer 's installation instructions and Contract Document requirements.
- B. Provide attachment and connection devices and methods necessary for securing Work. Secure work true to line and level. Anchor each product securely in place, accurately located, and aligned with other Work. Allow for expansion and building movement.
- C. Visual Effects: Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain best visual effect. Refer questionable choices to Architect for final decision.
- D. Install each component during weather conditions and Project status that will ensure best possible results. Isolate each part of completed construction from incompatible material as necessary to prevent deterioration.
- E. Coordinate temporary enclosures with required inspections and tests, to reduce necessity of uncovering completed construction for that purpose.
- F. Mounting Heights: Where mounting heights are not shown, install individual components at standard mounting heights recognized within the industry or local codes for that application. Refer questionable mounting height decisions to Architect for final decision.

**PART 2 - PRODUCTS Not Used****PART 3 - EXECUTION Not Used****END OF SECTION**

**SECTION 01 7400****CLEANING AND WASTE MANAGEMENT****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Administrative and procedural requirements for Cleaning and Waste Management as described in Contract Documents.
- B. Related Requirements:
  - 1. Section 01 1200: Coordination of responsibilities for waste management.
  - 2. Section 01 6400: Waste removal of Owner furnished products.
  - 3. In addition to standards described in this section, comply with all requirements for cleaning-up as described in various other Sections of these Specifications.

**1.2 REFERENCES**

- A. Definitions:
  - 1. Asphalt Pavement, Brick, and Concrete (ABC) Rubble: Rubble that contains only weathered (cured) asphalt pavement, clay bricks and attached mortar normally used in construction, or concrete that may contain rebar. The rubble shall not be mixed with, or contaminated by, another waster or debris.
  - 2. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
  - 3. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
  - 4. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
  - 5. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
  - 6. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
  - 7. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

**PART 2 - PRODUCTS: Not Used****PART 3 - EXECUTION****3.1 PROGRESS CLEANING**

- A. Comply with regulations of authorities having jurisdiction and safety standards for cleaning.
- B. Keep premises broom clean during progress of the Work.
- C. Keep site and adjoining streets reasonably clean. If necessary, sprinkle rubbish and debris with water to suppress dust.
- D. During handling and installation, protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from soiling, damage, or deterioration until Substantial Completion.

- E. Clean and maintain completed construction as frequently as necessary throughout construction period. Adjust and lubricate operable components to ensure ability to operate without damaging effects.
- F. Supervise construction activities to ensure that no part of construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.
- G. Before and during application of painting materials, clear area where such work is in progress of debris, rubbish, and building materials that may cause dust. Sweep floors and vacuum as required and take all possible steps to keep area dust free.
- H. Clean exposed surfaces and protect as necessary to avoid damage and deterioration.
- I. Place extra materials of value remaining after completion of associated work have become Owner's property as directed by Owner or Architect.
- J. Construction Waste Management And Disposal:
  - 1. Remove waste materials and rubbish caused by employees, Subcontractors, and contractors under separate contract with Owner and dispose of legally. Remove unsuitable or damaged materials and debris from building and from property.
    - a. Provide adequate waste receptacles and dispose of materials when full.
    - b. Properly store volatile waste and remove daily.
    - c. Do not deposit waste into storm drains, sanitary sewers, streams, or waterways. Do not discharge volatile, harmful, or dangerous materials into drainage systems.
  - 2. Do not burn waste materials or build fires on site. Do not bury debris or excess materials on Owner's property.

### 3.2 FINAL CLEANING

- A. Immediately before Substantial Completion, thoroughly clean building and area where The Work was performed. Remove all rubbish from under and about building, landscaped areas and parking lot and leave building and Project Site ready for occupancy by Owner.
- B. Comply with individual manufacturer's cleaning instructions.
- C. Clean each surface or unit to condition expected in normal, commercial building cleaning and maintenance program, including but not limited to:
  - 1. Interior Cleaning:
    - a. Clean inside glazing, exercising care not to scratch glass.
    - b. Remove marks, stains, fingerprints and dirt.
    - c. Clean and polish woodwork and finish hardware.
    - d. Remove labels that are not permanent labels.
    - e. Clean plumbing fixtures and tile work. Remove spots, soil or paint.
    - f. Clean surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean light fixtures and lamps.
    - g. Clean other fixtures and equipment and remove stains, paint, dirt, and dust.
    - h. Remove temporary floor protection and clean floors.
  - 2. Exterior Cleaning:
    - a. Clean outside glazing, exercising care not to scratch glass.
    - b. Remove marks, stains, and dirt from exterior surfaces.
    - c. Clean and polish finish hardware.
    - d. Remove temporary protection systems.
    - e. Clean dirt, mud, and other foreign material from paving, sidewalks, and gutters.
    - f. Clean drop inlets, through-curb drains, and other drainage structures.
    - g. Remove trash, debris, and foreign material from landscaped areas.

**END OF SECTION**



**SECTION 01 7700****CLOSEOUT PROCEDURES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes But is Not Limited To:
  - 1. Administrative and procedural requirements for Closeout Procedures.

**1.2 GENERAL**

- A. Closeout process consists of three specific project closeout inspections. Contractor shall plan sufficient time in construction schedule to allow for required inspections before expiration of Contract Time.
- B. Contractor shall conduct his own inspections of The Work and shall not request closeout inspections until The Work of the contract is reasonably complete and correction of obvious defects or omissions are complete or imminent.
- C. Date of Substantial Completion shall not occur until completion of construction work, unless agreed to by Architect and included on Certificate of Substantial Completion.

**1.3 PRELIMINARY CLOSEOUT REVIEW**

- A. When Architect, Owner and Contractor agree that project is ready for closeout, Pre-Substantial Inspection shall be scheduled. Preparation of floor substrate to receive carpeting and any work which could conceivably damage or stain carpet must be completed, as carpet installation will be scheduled immediately following this inspection.
- B. Prior to this inspection, completed test and evaluation reports for HVAC system and font, where one occurs, are to be provided to Project Manager, Architect, and applicable consultants.
- C. Architect and his appropriate consultants, together with Contractor and mechanical, plumbing, fire protection, and electrical sub-contractors shall conduct a space by space and exterior inspection to review materials and workmanship and to demonstrate that systems and equipment are operational.
  - 1. Punch list of items requiring completion and correction will be created.
  - 2. Time frame for completion of punch list items will be established, and date for Substantial Completion Inspection shall be set.

**1.4 SUBSTANTIAL COMPLETION INSPECTION**

- A. When Architect, Owner and Contractor agree that project is ready for Substantial Completion, an inspection is held. Punch list created at Pre-Substantial Inspection is to be substantially complete.
- B. Prior to this inspection, Contractor shall discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups and similar elements.
- C. Architect, Owner and Contractor review completion of punch list items. When Owner and Architect confirm that Contractor has achieved Substantial Completion of The Work, Owner, Architect and Contractor will execute Certificate of Substantial Completion that contains:
  - 1. Date of Substantial Completion.
  - 2. Punch List Work not yet completed, including seasonal and long lead items.
  - 3. Amount to be withheld for completion of Punch List Work.
  - 4. Time period for completion of Punch List Work.

5. Amount of liquidated damages set forth in Supplementary Conditions to be assessed if Contractor fails to complete Punch List Work within time set forth in Certificate.
- D. Contractor shall present Closeout Submittals to Architect and place tools, spare parts, extra stock, and similar items required by Contract Documents in locations as directed by Facilities Manager.

#### **1.5 FINAL ACCEPTANCE MEETING**

- A. When punch list items except for any seasonal items or long lead items which will not prohibit occupancy are completed, Final Acceptance Meeting is held.
- B. Owner, Architect and Contractor execute Owner's Project Closeout - Final Acceptance form, and verify:
  1. All seasonal and long lead items not prohibiting occupancy, if any, are identified, with committed to completion date and amount to be withheld until completion.
  2. Owner's maintenance personnel have been instructed on all system operation and maintenance as required by the Contract Documents.
  3. Final cleaning requirements have been completed.
- C. If applicable, once any seasonal and long lead items are completed, Closeout Inspection is held where Owner and Architect verify that The Work has been satisfactorily completed, and Owner, Architect and Contractor execute Closeout portion of the Project Closeout - Final Acceptance form.
- D. When Owner and Architect confirm that The Work is satisfactorily completed, Architect will authorize final payment.

**PART 2 - PRODUCTS Not Used**

**PART 3 - EXECUTION Not Used**

**END OF SECTION**

**SECTION 01 7800****CLOSEOUT SUBMITTALS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes But is Not Limited To:
  - 1. Administrative and procedural requirements for Closeout Submittals.
- B. Related Requirements:
  - 1. Section 01 3300: 'Submittal Procedures' for administrative and procedural requirements for submittal procedures.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- A. Project Record Documents:
  - 1. Do not use record documents for construction purposes:
    - a. Protect from deterioration and loss in secure, fire-resistive location.
    - b. Provide access to record documents for Architect's reference during normal working hours.
  - 2. Maintain clean, undamaged set of Drawings:
    - a. Mark set to show actual installation where installation varies from the Work as originally shown.
    - b. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
    - c. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.
    - d. Mark new information that is important to Owner, but was not shown on Drawings.
    - e. Note related Change Order numbers where applicable.
- B. As Built Record Drawings:
  - 1. As required in agreement with the Owner:
    - a. Architect will provide two full-size sets of prints of the As Built Record Drawings to the Facilities Management Office, printed from the updated AutoCAD drawing files or updated Revit model files, as specified by Owner, that have been modified to show actual dimensions and location of equipment, material, utility lines, and other work as actually constructed, based upon information provided by Contractor. Architect will submit updated As Built Record Drawings in PDF (ISO32000 format) to Owner.
    - b. Architect will submit following:
      - 1) Updated AutoCAD as built record drawing files with associated plot style tables or Revit as built record model files, as specified by Owner.
      - 2) Revit Model O&M lifecycle requirements to be tracked by Facility Manager.

**1.3 CLOSEOUT SUBMITTALS**

- A. Operations And Maintenance Manual:
  - 1. General:
    - a. Include closeout submittal documentation as required by Contract Documentation.
    - b. Include workmanship bonds, final certifications, equipment check-out sheets, and similar documents.
    - c. Releases enabling Owner unrestricted use of The Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
    - d. Include Project photographs, damage or settlement survey, and similar record information required by Contract Documents.
    - e. Submittal Format:

- 1) Digital copies unless otherwise noted, required for each individual specification section that include 'Closeout Submittals'.
  - 2) Include only closeout submittals as defined in individual specification section as required in Contract Documents.
2. Project Manual:
    - a. Copy of complete Project Manual including Addenda, Modifications as defined in General Conditions, and other interpretations issued during construction:
      - 1) Mark these documents to show variations in actual Work performed in comparison with text of specifications and Modifications.
      - 2) Show substitutions, selection of options, and similar information, particularly on elements that are concealed or cannot otherwise be readily discerned later by direct observation.
  3. Maintenance Contracts:
    - a. Digital format only.
  4. Operations and Maintenance Data:
    - a. Digital format only:
      - 1) Cleaning instructions.
      - 2) Maintenance instructions.
      - 3) Operations instructions.
      - 4) Equipment list.
      - 5) Parts list.
  5. Warranty Documentation:
    - a. Digital format of final, executed warranties.
  6. Record Documentation:
    - a. Digital format only.
      - 1) Certifications.
      - 2) Color and pattern selections.
      - 3) Design Data.
      - 4) Geotechnical Evaluation Reports (soils reports).
      - 5) Manufacture Reports.
      - 6) Manufacturer's literature or cut sheets.
      - 7) Shop Drawings.
      - 8) Source Quality Control.
      - 9) Special Procedures.
      - 10) Testing and Inspection Agency Reports.
      - 11) Testing and Inspection Reports.

#### **1.4 MAINTENANCE MATERIAL SUBMITTALS**

- A. Submit item(s) required by Section 01 3300 'Submittal Procedures' and as defined in individual specification section if required in Contract Documents. Items may be provided at completion of Work or with Closeout Submittals.

#### **1.5 WARRANTIES**

- A. When written guarantees beyond one (1) year after substantial completion are required by Contract Documents, secure such guarantees and warranties properly addressed and signed in favor of Owner. Include these documents in Operations & Maintenance Manual(s) specified above.
- B. Delivery of guarantees and warranties will not relieve Contractor from obligations assumed under other provisions of Contract Documents.

#### **PART 2 - PRODUCTS Not Used**

#### **PART 3 - EXECUTION Not Used**

**END OF SECTION**

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##### 06 0500 COMMON WORK RESULTS OF WOOD, PLASTICS, AND COMPOSITES

06 0573	PRESERVATIVE WOOD TREATMENT	C	*	SM	R	B	D	CM	SI	MO	UM
06 0573	INSECT PREVENTION WOOD TREATMENT	Cs	*	SMS	RS	*	*	CMS	Sis	MOs	UMs

##### 06 1000 ROUGH CARPENTRY

06 1011	WOOD FASTENINGS	C	*	SM	R	B	D	CM	SI	MO	UM
06 1100	WOOD FRAMING	C	*	SM	R	*	*	CM	SI	MO	*

##### 06 2000 FINISH CARPENTRY

06 2001	COMMON FINISH CARPENTRY REQUIREMENTS	C	*	SM	R	B	D	CM	SI	MO	UM
		C	*	SM	R	B	D	CM	SI	MO	UM

06 2210 MISCELLANEOUS WOOD TRIM

C \* SM R B D CM SI MO UM

**DIVISION 07: THERMAL AND MOISTURE PROTECTION**

**07 2000 THERMAL PROTECTION**

07 2116 BLANKET INSULATION

C \* SM R B D CM SI MO UM

**07 3000 STEEP SLOPE ROOFING**

07 3113 ASPHALT SHINGLES

**07 8000 SMOKE AND FIRE PROTECTION**

07 8400 FIRESTOPPING

C \* SM R B D CM SI MO UM

**07 9000 JOINT PROTECTION**

07 9213 ELASTOMERIC JOINT SEALANTS

07 9219 ACOUSTICAL JOINT SEALANTS

C \* SM R B D CM SI MO UM

**DIVISION 08: OPENINGS**

**08 3000 SPECIALTY DOORS AND FRAMES**

08 3110 ACCESS DOORS AND PANELS

C \* SM R B D CM SI MO UM  
C \* SM R B D CM SI MO UM

**08 7000 HARDWARE**

08 7101 COMMON FINISH HARDWARE REQUIREMENTS

C \* SM R B D CM SI MO UM

08 7108 STOPS AND HOLDERS

C \* SM R B D CM SI MO UM

08 7109 ACCESSOIRES

C \* SM R B D CM SI MO UM

**DIVISION 09: FINISHES**

**09 2000 PLASTER AND GYPSUM BOARD**

C \* SM R B D CM \* \* UM

09 2900 GYPSUM BOARD

C \* SM R B D CM SI MO UM

**09 5000 CEILINGS**

09 5116 ACOUSTICAL TILE CEILINGS

**09 6000 FLOORING**

09 6816 SHEET CARPETING: BACK CUSHION, DIRECT GLUE

09 5153 DIRECT-APPLIED ACOUSTICAL CEILINGS

\* \* \* Rs \* \* \* \* \*

**09 9000 PAINTS AND COATINGS**

09 9001 COMMON PAINTING AND COATING REQUIREMENTS

09 9121 INTERIOR PANTED POURED CONCRETE

09 9122 INTERIOR PAINTED CMU

09 9115 EXTERIOR PAINTED WOOD

09 9125 INTERIOR PAINTED WOOD

09 9413 INTERIOR TEXTURED FINISHING

C \* SM R B D CM SI MO UM  
Cs \* SMs Rs \* \* CMs \* \* \*

C \* SM R B D CM SI MO UM

**DIVISION 10: SPECIALTIES**

**10 1000 INFORMATION SPECIALTIES**

10 1495 MISCELLANEOUS INTERIOR SIGNAGE

10 1495 MISCELLANEOUS INTERIOR SIGNAGE

\* \* \* Rs \* \* \* \* \*

**SITE AND INFRASTRUCTURE SUBGROUP**

**DIVISION 31: EARTHWORK**

**31 0500 COMMON WORK RESULTS FOR EARTHWORK**

31 0501 COMMON EARTHWORK REQUIREMENTS

C \* SM R B D CM SI MO UM

**31 1000 SITE CLEARING**

31 1123 AGGREGATE BASE

C \* SM R B D CM SI MO UM

**DIVISION 32: EXTERIOR IMPROVEMENTS**

**32 8000 IRRIGATION**

32 8423 UNDERGROUND SPRINKLERS

C \* SM R B D CM SI MO UM

**32 9000 PLANTING**

32 9001 COMMON PLANTING REQUIREMENTS

32 9300 PLANTS

C \* SM R B D CM SI MO UMs

**DIVISION 02: EXISTING CONDITIONS**

**02 4000 DEMOLITION AND STRUCTURE MOVING**

02 4119 SELECTIVE STRUCTURE DEMOLITION

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**SECTION 02 4119****SELECTIVE STRUCTURE DEMOLITION****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
1. Demolition and removal of selected portions of building or structure.

**1.2 REFERENCES**

- A. Reference Standards:
1. National Fire Protection Association / American National Standards Institute:
    - a. NFPA 241, 'Standard for Safeguarding Construction, Alteration, and Demolition Operations', 2013 Edition.
  2. American Society of Safety Engineers:
    - a. ASSE A10.6-2006, 'Safety Requirements for Demolition Operations'.

**1.3 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
1. Storage or sale of removed items or materials will not be permitted on-site.
- B. Pre-Installation Conference:
1. Before beginning Selective Demolition work, in addition to requirements of Section 01 3100, meet on site to confirm work to be demolished, items to be salvaged or reused, and coordination with Owner.
- C. Scheduling:
1. Indicate detailed sequence of selective demolition and removal work, with starting and ending dates for each activity, on Schedule specified in Section 01 3200.

**1.4 SUBMITTALS**

- A. Informational Submittals:
1. Special Procedure Submittals:
    - a. Inventory:
      - 1) After selective demolition is complete, submit list of items that have been removed and salvaged.

**1.5 QUALITY ASSURANCE**

- A. Regulatory Agency Sustainability Approvals:
1. Comply with governing EPA notification regulations before beginning selective demolition.
  2. Comply with hauling and disposal regulations of authorities having jurisdiction.
  3. Standards: Comply with ANSI A10.6 and NFPA 241.

## 1.6 FIELD CONDITIONS

- A. Existing Conditions:
  - 1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

## PART 2 - PRODUCTS: Not Used

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification Of Conditions:
  - 1. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
    - a. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- B. Evaluation And Assessment:
  - 1. Hazardous Materials:
    - a. It is not expected that hazardous materials will be encountered in the Work. Identified hazardous materials will be removed by Owner before start of the Work.
    - b. If materials suspected of containing hazardous materials are encountered, do not disturb and immediately notify Architect.
  - 2. Inventory and record condition of items to be removed and reinstalled and items to be removed and salvaged.
  - 3. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure nature and extent of conflict. Promptly submit written report to Architect.
  - 4. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
  - 5. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

### 3.2 PREPARATION

- A. Temporary Facilities:
  - 1. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 2. Maintain fire-protection facilities in service during selective demolition operations.
- B. Temporary Shoring:
  - 1. Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
  - 2. Strengthen or add new supports when required during progress of selective demolition.
- C. Utility Services:
  - 1. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
  - 2. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
    - a. Arrange to shut off indicated utilities with utility companies.

- b. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

### 3.3 SELECTIVE DEMOLITION

#### A. General:

1. Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
2. Demolish and remove existing construction only to extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - a. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
  - b. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - c. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
  - d. Maintain adequate ventilation when using cutting torches.
  - e. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  - f. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  - g. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  - h. Dispose of demolished items and materials promptly.

#### B. Selective Demolition Procedures For Specific Materials:

1. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.
2. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
3. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

#### C. Removed and Salvaged Items:

1. Relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.
  - a. Clean salvaged items as directed by Owner.
  - b. Pack or crate items after cleaning. Identify contents of containers.
  - c. Store items in a secure area until delivery to Owner.
  - d. Transport items to Owner's storage area designated by Owner.
  - e. Protect items from damage during transport and storage.

#### D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

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

### **3.4 CLEANING**

- A. General:
  - 1. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations.
  - 2. Return adjacent areas to condition existing before selective demolition operations began.
- B. Waste Management:
  - 1. Disposal of Demolished Materials:
    - a. Remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill. Do not burn demolished materials.
      - 1) Do not allow demolished materials to accumulate on-site.
      - 2) Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
      - 3) Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

**END OF SECTION**

**DIVISION 03: CONCRETE**

**03 1000 CONCRETE FORMING AND ACCESSORIES**

03 1113 STRUCTURAL CAST-IN-PLACE CONCRETE FORMING

**03 3000 CAST-IN-PLACE CONCRETE**

03 3111 CAST-IN-PLACE STRUCTURAL CONCRETE

03 3923 MEMBRANE CONCRETE CURING

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**SECTION 03 1113****STRUCTURAL CAST-IN-PLACE CONCRETE FORMING****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Design, construction, and safety of formwork.
  - 2. Furnish and install required formwork ready for placing of concrete.
  - 3. Strip and dispose of formwork.
- B. Related Requirements:
  - 1. Section 03 3111: 'Cast-In-Place Structural Concrete' for:
    - a. Tolerances for placing structural concrete.
    - b. Pre-installation conference held jointly with other concrete related sections.

**1.2 REFERENCES**

- A. Reference Standards:
  - 1. American Concrete Institute:
    - a. ACI 318-14, 'Building Code Requirements for Structural Concrete and Commentary'.

**1.3 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-Installation Conference:
  - 1. Participate in pre-installation conference as specified in Section 03 3111.
  - 2. In addition to agenda items specified in Section 01 3100 and 31 3111, review following:
    - a. Review Section 01 4523 for Testing and Inspection administrative requirements and responsibilities and Field Quality Control tests and inspections required of this section.
      - 1) Review requirements and frequency of testing and inspections.
- B. Scheduling:
  - 1. Notify Testing Agency and Architect as directed in Section 03 3111.

**1.4 SUBMITTALS**

- A. Informational Submittals:
  - 1. Manufacturer Instructions:
    - a. Printed application instructions for form release agents.

**PART 2 - PRODUCTS****2.1 COMPONENTS**

- A. Forms: Wood, metal, or plastic as arranged by Contractor:
  - 1. Forming material shall be compatible with specified form release agents and with finish requirements for concrete to be left exposed or to receive a smooth rubbed finish.



## 2.2 ACCESSORIES

- A. Form Release Agents:
  - 1. Unexposed Surfaces Only: Contractor's option.
- B. Expansion / Contraction Joints:
  - 1. **1/2 inch (13 mm)** thick.
  - 2. Manufactured commercial fiber type:
    - a. Meet requirements of ASTM D1751.
    - b. Type Two Acceptable Products:
      - 1) Conflex by Knight-Celotex, Northfield, IL [www.aknightcompany.com](http://www.aknightcompany.com).
      - 2) Sealtight by W R Meadows Inc, Hampshire, IL [www.wrmeadows.com](http://www.wrmeadows.com).
      - 3) Equal as approved by Architect before installation. See Section 01 6200.
  - 3. Recycled Vinyl:
    - a. Light gray color.
    - b. Type Two Acceptable Products:
      - 1) Proflex by Oscoda Plastics Inc, Oscoda, MI [www.oscodaplastics.com](http://www.oscodaplastics.com).
      - 2) Equal as approved by Architect before Installation. See Section 01 6200.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Forms:
  - 1. Assemble forms so forms are sufficiently tight to prevent leakage.
  - 2. Properly brace and tie forms.
  - 3. Make proper form adjustments before, during, and after concreting.
  - 4. Use new forms, or used forms that have been cleaned of loose concrete and other debris from previous concreting and repaired to proper condition. Use APA Plyform B-B Class I, or APA HDO Plyform B-B Class I, on exposed to view concrete that do not receive a smooth rubbed finish.
- B. Accessories:
  - 1. General:
    - a. Provide for installation of inserts, templates, fastening devices, sleeves, and other accessories to be set in concrete before placing.
    - b. Position anchor bolts for hold-down anchors and columns and securely tie in place before placing concrete.
  - 2. Form Release / Finish Agents:
    - a. Film thickness shall be no thicker than as recommended by Manufacturer.
    - b. Allow no release / finish agent on reinforcing steel or footings.
  - 3. Expansion Joints:
    - a. Install at joints between floor slab and foundation wall where shown on Drawings.
- C. Form Removal (Slab on Grade):
  - 1. Removal of forms can usually be accomplished in twelve (12) to twenty-four (24) hours.
  - 2. If temperature is below **50 deg F (10 deg C)** or if concrete (stairs, beams, etc) depends on forms for structural support, leave forms intact for sufficient period for concrete to reach adequate strength.
  - 3. For exposed to view surfaces that receive a smooth rubbed finish, remove forms while concrete is still "green".
  - 4. Metal bars or prys should not be used. Use wood wedges, tapping gradually when necessary.

### 3.2 FIELD QUALITY CONTROL

- A. Field Tests And Inspections:
  - 1. Concrete Formwork:
    - a. Inspections are not required and will be performed at discretion of Architect.

**END OF SECTION**

**SECTION 03 3111****CAST-IN-PLACE STRUCTURAL CONCRETE****PART 1 - GENERAL****1.1 SUMMARY****A. Includes But Not Limited To:**

1. Furnish and install concrete work as described in Contract Documents including:
  - a. Quality of concrete used on Project but furnished under other Sections.
  - b. Concrete mix information and use of admixtures.
  - c. Field Quality Control Testing and Inspection requirements for concrete.
  - d. Pre-installation conference held jointly with other concrete related sections.
  - e. Sealants and curing compounds used with concrete.
  - f. Compact aggregate base for miscellaneous cast-in-place concrete.
  - g. Miscellaneous cast-in-place concrete and equipment pads.

**B. Products Installed But Not Furnished Under This Section:**

1. Concrete accessories.
2. Inserts, bolts, boxes, templates, and fastening devices for other work, including those for bases only for Mechanical and Electrical.
3. Membrane Concrete Curing.

**C. Related Requirements:**

1. Section 01 0000: 'General Requirements':
  - a. Section 01 1200: 'Multiple Contract Summary' for Owner Furnished Testing and Inspecting Services.
  - b. Section 01 4523: 'Testing and Inspecting Services' for testing and inspection, and testing laboratory services for materials, products, and construction methods.
2. Section 03 1113: 'Structural Cast-In-Place Concrete Forming'.
3. Section 03 3923: 'Membrane Concrete Curing' for quality of curing materials used.
4. Section 07 9213: 'Elastomeric Joint Sealant' for quality of sealants.
5. Section 31 1123: 'Aggregate Base' for aggregate base under miscellaneous cast-in-place concrete and exterior slabs, under interior slabs-on-grade concrete, and asphalt paving.
6. Section 32 8423: 'Underground Sprinklers' for sleeves for underground irrigation system.
7. Divisions 22, 23, And 26: Mechanical and electrical devices including boxes, conduits, pipes, hangers, inserts, and other work to be embedded in concrete work before placing.
8. Furnishing of items to be embedded in concrete specified in Section involved.
9. Owner will provide concrete leveling compounds and patching compounds required for carpet installation.

**1.2 REFERENCES****A. Association Publications:**

1. American Concrete Institute, Farmington Hills, MI [www.concrete.org](http://www.concrete.org). Abstracts of ACI Periodicals and Publications.
  - a. ACI 117.1R-14: 'Guide for Tolerance Compatibility in Concrete Construction'.
  - b. Certifications:
    - 1) ACI CP-1(16), '*Technical Workbook for ACI Certification of Concrete Field Testing Technician-Grade 1*'.
    - 2) ACI CP-10(10), '*Craftsman Workbook for ACI Certification of Concrete Flatwork Technician/Finisher*'.
    - 3) ACI CP-19(16), '*Technical Workbook for ACI Certification of Concrete Strength Testing Technician*'.

## B. Definitions:

1. Cold Weather, as referred to in this Section, is four (4) hours with ambient temperature below **40 deg F (4.4 deg C)** in twenty-four (24) hour period.
2. Floor Flatness ( $F_F$ ): Rate of change in elevation of floor over **12 inches (305 mm)** section.
3. Floor Levelness ( $F_L$ ): Measures difference in elevation between two points which are **10 feet (3.05 m)** apart.
4. Hot Weather, as referred to in this Section, is ambient air temperature above **100 deg F (38 deg C)** or ambient air temperature above **90 deg F (32 deg C)** with wind velocity **8 mph (12.9 kph)** or greater.

## C. Reference Standards:

1. American Association of State and Highway Transportation Officials:
  - a. AASHTO M 153-06 (2016), 'Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction'.
2. American Concrete Institute
  - a. ACI 117-10 (R2015): 'Specifications for Tolerances for Concrete Construction and Materials and Commentary'.
  - b. ACI 305.1-14, 'Specification for Hot Weather Concreting'.
  - c. ACI 306.1-90 (R2002), 'Standard Specification for Cold Weather Concreting'.
  - d. ACI 318-14, 'Building Code Requirements for Structural Concrete' (ACI 318) and 'Commentary on Building Code Requirements for Structural Concrete' (ACI 318R).
3. ASTM International:
  - a. ASTM C31/C31M-19, 'Standard Practice for Making and Curing Concrete Test Specimens in the Field'.
  - b. ASTM C33/C33M-18, 'Standard Specification for Concrete Aggregates'.
  - c. ASTM C39/C39M-18, 'Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens'.
  - d. ASTM C94/C94M-17a, 'Standard Specification for Ready-Mixed Concrete'.
  - e. ASTM C140/C140M-18a, 'Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units'.
  - f. ASTM C143/C143M-15a, 'Standard Test Method for Slump of Hydraulic-Cement Concrete'.
  - g. ASTM C150/C150M-18, 'Standard Specification for Portland Cement'.
  - h. ASTM C172/C172M-17, 'Standard Practice for Sampling Freshly Mixed Concrete'.
  - i. ASTM C173/C173M-16, 'Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method'.
  - j. ASTM C192/C192M-18, 'Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory'.
  - k. ASTM C231/C231M-17a, 'Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method'.
  - l. ASTM C260/C260M-10a(2016), 'Standard Specification for Air-Entraining Admixtures for Concrete'.
  - m. ASTM C330/C330M-17a, 'Standard Specification for Lightweight Aggregates for Structural Concrete'.
  - n. ASTM C494/C494M-17, 'Standard Specification for Chemical Admixtures for Concrete'.
  - o. ASTM C496/C496M-17, 'Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens'.
  - p. ASTM C567/C567M-14, 'Standard Test Method for Determining Density of Structural Lightweight Concrete'.
  - q. ASTM C595/C595M-18, 'Standard Specification for Blended Hydraulic Cements'.
  - r. ASTM C618-19, 'Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete'.
  - s. ASTM C1077-17, 'Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation'.
  - t. ASTM C1157/C1157M-17, 'Standard Performance Specification for Hydraulic Cement'.
  - u. ASTM E329-18: 'Standard Specification for Agencies Engaged in Construction Inspection and/or Testing'.
4. International Code Council (IBC) (2018 or latest approved edition):
  - a. IBC Chapter 17, 'Special Inspections And Tests'.
    - 1) Section 1704, 'Special Inspections And Tests, Contractor Responsibility And Structural Observations'.

- 2) Section 1705, 'Required Special Inspection And Tests'.
  - a) Section 1705.2, 'Steel Construction'.

### 1.3 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Conference:
  1. Participate in MANDATORY pre-installation conference as specified in Section 01 3100 and held jointly with following sections:
    - a. Section 03 1113: 'Structural Cast-In-Place Concrete Forming'.
  2. Schedule pre-installation conference prior to placing of footings, installation of foundation forms and reinforcing steel, and installation of anchors, dowels, inserts, and block outs in foundation walls and slabs.
  3. In addition to agenda items specified in Section 01 3100, review following:
    - a. Set up concrete placement pour card system and verify that all relevant trades have signed off prior to concrete placement.
    - b. Obtaining trade sign-offs on each pour card will be responsibility of General Contactor's foreman or whoever is in charge of ordering concrete.
    - c. Pour cards will be turned in to Quality Assurance representative after the work has been completed so that they can be reviewed and filed.
    - d. Review installation scheduling, coordination, placement of building concrete, and placement of items installed in and under concrete.
    - e. Review installation scheduling, coordination and placement of site concrete and of items installed in concrete.
    - f. Review 'Verification of Conditions' requirements.
    - g. Review requirements for preparation of subgrade and aggregate base requirements.
    - h. Review formwork requirements.
    - i. Review approved mix design requirements, mix designs and use of admixtures.
    - j. Review placement, finishing, and curing of concrete, including cold and hot weather requirements.
    - k. Review joint layout plan for control and expansion joints, fillers for sidewalks, curbs, and gutters:
      - 1) Review jointing requirements.
    - l. Review safety issues.
    - m. Review Section 01 4523 for Testing and Inspection administrative requirements and responsibilities and Field Quality Control tests and inspections required of this section.
      - 1) Review requirements and frequency of testing and inspections.
- B. Scheduling:
  1. Notify Testing Agency and Architect twenty-four (24) hours minimum before placing concrete.

### 1.4 SUBMITTALS

- A. Action Submittals:
  1. Joint layout plan for control and expansion joints for sidewalks, curbs, and gutters for written approval before starting work on this Section.
- B. Informational Submittals:
  1. Certificates:
    - a. Installers:
      - 1) Certification for National Ready Mixed Concrete Association (NRMCA).
      - 2) Certification for ACI-certified Flatwork Finishers and Technicians.
  2. Design Data:
    - a. Mix Design:
      - 1) Furnish proposed mix design to Architect for review prior to commencement of Work.
        - a) Include density (unit weight) and void content determined per ASTM C1688/C1688M for fresh mixed properties and per ASTM C140/C140M for hardened concrete properties.

- b) Mix design shall show proposed admixture, amount, usage instructions, and justification for proposed use.
- b. Ready-Mix Supplier:
  - 1) Require mix plant to furnish delivery ticket for each batch of concrete. Keep delivery tickets at job-site for use of Owner or his representatives. Tickets shall show following:
    - a) Name of ready-mix batch plant.
    - b) Serial number of ticket.
    - c) Date and truck number.
    - d) Name of Contractor.
    - e) Name and location of Project.
    - f) Specific class or designation of concrete conforming to that used in Contract Documents.
    - g) Amount of concrete.
    - h) Amount and type of cement.
    - i) Total water content allowed by mix design.
    - j) Amount of water added at plant.
    - k) Sizes and weights of sand and aggregate.
    - l) Time loaded.
    - m) Type, name, manufacturer, and amount of admixtures used.
    - n) Design Data.
  - 2) Provide certificates with supporting testing reports verifying compliance with Contract Document requirements and that materials provided are from single source for following:
    - a) Cement.
    - b) Aggregate.
    - c) Fly Ash.
- 3. Source Quality Control Submittals:
  - a. Concrete mix design: Submit mix designs to meet following requirements:
    - 1) Mix Type A:
      - a) General purpose concrete type mix used for footings and for exterior concrete (excluding concrete paving) where not subject to freeze/thaw cycles and deicing or where higher strength is needed due to soil conditions.
      - b) **3000 psi (20.68 MPa)** minimum at twenty-eight (28) days.
      - c) Water / Cementitious Material: 0.45 to 0.50 by weight.
    - 2) Mix Type B:
      - a) Unexposed interior concrete slabs on grade.
      - b) **3500 psi (24.13 MPa)** minimum at twenty-eight (28) days.
      - c) Water / Cementitious Material: 0.45 maximum by weight.
    - 3) Mix Type D:
      - a) For exterior concrete paving, curbs, gutters, and waterways not exposed to freeze/thaw cycles and deicing salts.
      - b) **4000 psi (27.58 MPa)** minimum at twenty-eight (28) days.
      - c) Water / Cementitious Material: 0.45 maximum by weight.
      - d) For concrete paving, use mix design based upon use of **1-1/2 inches (38 mm)** coarse aggregate (about 15 percent).
    - 4) Mix Type E:
      - a) Exterior concrete exposed to freeze/thaw cycles and deicing salts or where soils are 'corrosive'.
      - b) **4500 psi (31.03 MPa)** minimum at twenty-eight (28) days.
      - c) Water / Cementitious Material: 0.40 maximum by weight.
      - d) Use twenty-five (25) percent Class F fly ash as part of cementitious material.
      - e) Mix Type F should be used for all exterior concrete exposed to freeze/thaw cycles and deicing salts, unless dictated otherwise by site conditions.
      - f) For concrete paving, use mix design based upon use of **1-1/2 inches (38 mm)** coarse aggregate (about 15 percent).
    - 5) Mix Type F - Self-Consolidating Concrete (SCC):
      - a) Rarely used optional mix type.
      - b) Self-consolidating concrete may be used for all architectural concrete, heavily reinforced concrete, concrete for structural repairs, and other members as described in contract documents.

- c) 4000 psi (27.58 MPa) minimum at twenty-eight (28) days.
  - d) All self-consolidating concrete shall contain high-range water-reducing admixture and viscosity-modifying admixture where required.
  - e) Minimum flow of 20 inches (508 mm) – 30 inches (762 mm) or as required by successful test placement.
  - f) Workability, pump ability, finish ability, and setting time of mix design shall be verified with successful test placement onsite.
  - g) Viscosity Modifying Admixture (VMA) shall be used to optimize viscosity of Self-Consolidating Concrete (SCC) at dosage rates per manufacturer's recommendation.
- 6) Air Entrainment: Six (6) percent, plus or minus 1-1/2 percent for exterior concrete and foundation walls exposed to freeze/thaw cycles.
- 7) Do not add water any time during mixing cycle above amount required to meet specified water / cement ratio. No reduction in amount of cementitious material is allowed.
- b. Slump:
- 1) 4 inch (100 mm) slump maximum before addition of high range water reducer.
  - 2) 8 inch (200 mm) slump maximum with use of high range water reducer.
  - 3) Slump not required for Mix Type G.
- c. Admixtures:
- 1) Mix design shall show proposed admixture, amount, usage instructions, and justification for proposed use. Do not use any admixture without Architect's written approval.
  - 2) Fly ash: Amount of specified Class F (or Class C where Class F is not available) fly ash not to exceed twenty-five (25) percent of weight of cementations materials may used.
  - 3) Chemical:
    - a) Specified accelerator or retarder may be used if necessary to meet environmental conditions.
    - b) Special additives to promote rapid drying concrete, or moisture vapor reduction (MVRA), may be used in interior concrete slabs on grade and elevated concrete decks that will receive flooring if necessary to meet construction schedules.
- C. Closeout Submittals:
- 1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    - a. Record Documentation:
      - 1) Pour Reports:
        - a) Provide report that records following information:
        - b) Date and time of start of pour, Date and time of end of pour, and Date and time of end of finishing procedures.
        - c) Temperature at start of pour, Temperature at end of Pour, and Maximum temperature during performance of finishing procedures.
        - d) Wind speed at start of pour, Wind speed at end of pour, and Maximum wind speed during performance of finishing procedures.
        - e) Humidity at start of pour, Humidity at end of pour, and High and low humidity during performance of finishing procedures.
        - f) Cloud cover at start of pour, Cloud cover at end of pour, and High and low cloud cover during performance of finishing procedures.
        - g) Screeding method and equipment used.
        - h) Saw cut method and equipment used.
      - 2) Testing and Inspection Reports:
        - a) Testing Agency Testing and Inspecting Reports of concrete.
      - 3) Warranty. Submit rapid concrete drying or MVRA manufacturer warranties for concrete moisture vapor emission induced flooring failure and adhesion; ensure both have been completed in project's name and registered with manufacturer.
        - a) Provide warranty to cover cost of flooring failures due to moisture migration from slabs for life of concrete. Include cost of repair or removal of failed flooring, placement of topical moisture remediation system, and replacement of flooring with comparable flooring system.
        - b) Provide stand-alone adhesion warranty matching duration of flooring adhesive or primer manufacturer's material defect warranty.

## 1.5 QUALITY ASSURANCE

- A. Qualifications: Requirements of Section 01 4301 applies, but is not limited to following:
1. Installers and Installation Supervisor:
    - a. ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
  2. Ready-Mix Supplier:
    - a. Comply with ASTM C94/C94M requirements and be certified according to NRMCA's 'Certification of Ready Mixed Concrete Production Facilities'.
  3. Testing Agencies:
    - a. Independent agency qualified according to ASTM C1077 and ASTM E329.
      - 1) Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technicians, Grade I according to ACI CP-1 or equivalent certification program.
      - 2) Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be ACI-certified Concrete Laboratory Testing Technician - Grade II.
- B. Testing And Inspection:
1. Owner is responsible for Quality Assurance. Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor.
  2. Owner will provide Testing and Inspection on concrete:
    - a. Owner will employ testing agencies to perform testing and inspection on concrete as specified in Field Quality Control in Part 3 of this specification:
      - 1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform the Work in strict accordance with requirements of Contract Documents and perform contractor testing and inspection.
      - 2) See Section 01 1200: 'Multiple Contract Summary'.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery And Acceptance Requirements:
1. Expansion Joint Filler Material:
    - a. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage And Handling Requirements:
1. Expansion Joint Filler Material:
    - a. Store materials in a clean, dry area in accordance with manufacturer's instructions.
    - b. Protect materials during handling and application to prevent damage.

## PART 2 - PRODUCTS

### 2.1 SYSTEM

- A. Manufacturers:
1. Manufacturer Contact List:
    - a. Aridus Admixture by US Concrete, Eules, TX [www.us-concrete.com/aridus/](http://www.us-concrete.com/aridus/).
    - b. BASF (Construction Chemicals Division), Cleveland, OH [www.master-builders-solutions.basf.us/en-us](http://www.master-builders-solutions.basf.us/en-us).
    - c. Bonsal American, Charlotte, NC [www.bonsal.com](http://www.bonsal.com).
    - d. Concure Systems Admixture by Concure Systems, Phoenix, AZ [www.ConcureSystems.com](http://www.ConcureSystems.com).
    - e. Dayton Superior Specialty Chemicals, Kansas City, KS [www.daytonsuperiorchemical.com](http://www.daytonsuperiorchemical.com).
    - f. Euclid Chemical Company, Cleveland, OH [www.euclidchemical.com](http://www.euclidchemical.com).
    - g. Fritz-Pak Concrete Admixtures, Dallas, TX [www.fritzpak.com](http://www.fritzpak.com).

- h. GCP Applied Technologies, Cambridge, MA [www.gcpat.com/construction/en-us](http://www.gcpat.com/construction/en-us).
  - i. ISE Logik Industries, Gulfport, MS [www.iselogik.com](http://www.iselogik.com).
  - j. Kryton International Inc., Vancouver, British Columbia, Canada [www.kryton.com](http://www.kryton.com).
  - k. L & M Construction Chemicals, Omaha, NE [www.lmcc.com](http://www.lmcc.com).
  - l. Larsen Weldcrete by Larsen Products Corp, Rockville, MD [www.larsenproducts.com](http://www.larsenproducts.com).
  - m. Sika Corporation, Lyndhurst, NJ [www.sikaconstruction.com](http://www.sikaconstruction.com) and Sika Canada, Pointe Claire, QC [www.sika.ca](http://www.sika.ca).
  - n. Unitex, Kansas City, MO [www.unitex-chemicals.com](http://www.unitex-chemicals.com).
  - o. U S Mix Products Co, Denver, CO [www.usspec.com](http://www.usspec.com).
  - p. W R Meadows, Hampshire, IL [www.wrmeadows.com](http://www.wrmeadows.com).
- B. Performance:
1. Design Criteria: Conform to requirements of ASTM C94/C94M unless specified otherwise:
  2. Capacities:
    - a. For testing purposes, following concrete strengths are required:
      - 1) At 7 days: 70 percent minimum of 28 day strengths.
      - 2) At 28 days: 100 percent minimum of 28 day strengths.
- C. Materials:
1. Hydraulic Cement: Meet requirements of ASTM C150/C150M, Type <Insert Type>.
    - a. Meet requirements of ASTM C595/C595M, Type <Insert Type>.
    - b. Meet requirements of ASTM C1157/C1157M, Type <Insert Type>.
  2. Aggregates:
    - a. Coarse:
      - 1) Meet requirements of ASTM C33/C33M or nonconforming aggregate that by test or actual service produces concrete of required strength and conforms to local governing codes.
      - 2) Aggregate shall be uniformly graded by weight.
    - b. Fine:
      - 1) Meet requirements of ASTM C33/C33M.
      - 2) Aggregate shall be uniformly graded by weight.
  3. Water: Clear, apparently clean, and potable.
  4. Admixtures And Miscellaneous:
    - a. Fly Ash:
      - 1) Meet requirements of ASTM C618, Class F (or Class C where Class F is not available) and with loss on ignition (LOI) of three (3) percent maximum.
    - b. Chemical:
      - 1) No admixture shall contain calcium chloride nor shall calcium chloride be used as an admixture. All chemical admixtures used shall be from same manufacturer and compatible with each other.
      - 2) Air Entraining Admixture:
        - a) Meet requirements of ASTM C260/C260M.
      - 3) Water Reducing Admixture:
        - a) Meet requirements of ASTM C494/C494M, Type A and containing not more than 0.05 percent chloride ions.
        - b) Type Two Acceptable Products:
          - (1) Equal as approved by Architect before use. See Section 01 6200.
      - 4) Water Reducing, Retarding Admixture:
        - a) Meet requirements of ASTM C494/C494M, Type D and contain not more than 0.05 percent chloride ions.
        - b) Type Two Acceptable Products:
          - (1) Equal as approved by Architect before use. See Section 01 6200.
      - 5) High Range Water Reducing Admixture (Superplasticizer):
        - a) Meet requirements of ASTM C494/C494M, Type F or G and containing not more than 0.05 percent chloride ions.
        - b) Type Two Acceptable Products:
          - (1) Equal as approved by Architect before use. See Section 01 6200.
      - 6) Non-Chloride, Non-Corrosive Accelerating Admixture:
        - a) Meet requirements of ASTM C494/C494M, Type C or E and containing not more than 0.05 percent chloride ions.



- b) Type Two Acceptable Products:
  - (1) Equal as approved by Architect before use. See Section 01 6200.
- 7) Corrosion Inhibiting Admixture:
  - a) Liquid admixture to inhibit corrosion of steel reinforcement in concrete by introducing proper amount of anodic inhibitor. Admixture shall contain thirty (30) percent calcium nitrite solution and shall be used where called for in specifications or on drawings.
  - b) Type Two Acceptable Products:
    - (1) Eucon CIA by Euclid.
    - (2) DCI or DCI-S by GCP Applied Technologies.
    - (3) Equal as approved by Architect before use. See Section 01 6200.
- 8) Alkali-Silica Reactivity Inhibiting Admixture:
  - a) Specially formulated lithium nitrate admixture for prevention of alkali-silica reactivity (ASR) in concrete. Admixture must have test data indicating conformance to ASTM C1293.
  - b) Type Two Acceptable Products:
    - (1) Eucon Integral ARC by Euclid.
    - (2) RASIR by W R Grace.
    - (3) Equal as approved by Architect before use. See Section 01 6200.
- 9) Viscosity Modifying Admixture (VMA):
  - a) Liquid admixture used to optimize viscosity of Self-Consolidating Concrete (SCC). Subject to compliance with requirements, provide following at dosage rates per manufacturer's recommendation.
  - b) Type Two Acceptable Products:
    - (1) Equal as approved by Architect before use. See Section 01 6200.
- 10) Shrinkage Reducing Admixture (SRA):
  - a) Liquid admixture specifically designed to reduce drying shrinkage and potential for cracking.
  - b) Type Two Acceptable Products:
    - (1) Equal as approved by Architect before use. See Section 01 6200.
- 11) Rapid Drying Admixture in Interior Concrete Slabs on Grade:
  - a) Admixture specifically designed to promote rapid drying of concrete.
  - b) Type Two Acceptable Products:
    - (1) Equal as approved by Architect before use. See Section 01 6200.
- 12) Moisture Vapor Reduction Admixture (MVRA):
  - a) Liquid, inorganic, ASTM C494/C494M Type S Admixture free of volatile organic compounds (VOCs); specifically formulated to close capillary systems formed during concrete placement and to reduce moisture vapor emission and transmission with no adverse effect on concrete properties or finish flooring.
  - b) Type Two Acceptable Products:
    - (1) MVRA 900 by ISE Logik Industries: [www.iselogik.com](http://www.iselogik.com).
    - (2) Concure Systems Admixture by Concure Systems, Phoenix, AZ [www.ConcureSystems.com](http://www.ConcureSystems.com).
    - (3) Equal as approved by Architect before use. See Section 01 6200.
- 13) Waterproofing Admixture: Admixture formulated to reduce permeability to liquid water, with no adverse effect on concrete properties:
  - a) Functioning by growth of crystals in capillary pores.
  - b) Permeability of Cured Concrete: No measurable leakage when tested in accordance with COE CRD-C 48 at 200 feet of head; provide test reports.
  - c) Type Two Acceptable Products:
    - (1) CWPA 800 by ISE Logik Industries: [www.iselogik.com](http://www.iselogik.com).
    - (2) Krystol Internal Membrane (KIM) by Kryton: [www.kryton.com](http://www.kryton.com).
    - (3) Equal as approved by Architect before use. See Section 01 6200.

## 2.2 ACCESSORIES

### A. Formwork:

1. Meet requirements specified in Section 03 1113:

- B. Bonding Agents:
1. Type Two Acceptable Products:
    - a. Acrylic Additive by Bonsal American.
    - b. Day Chem Ad Bond (J-40) by Dayton Superior.
    - c. Flex-Con by Euclid Chemical Co.
    - d. Larsen Weldcrete by Larsen Products Corp.
    - e. Everbond by L & M Construction Chemicals.
    - f. MasterEmaco A 660 (formally Acryl 60) by BASF.
    - g. U S Spec Multicoat by U S Mix Products.
    - h. Intralok by W R Meadows.
    - i. Equal as approved by Architect before use. See Section 01 6200.
- C. Expansion Joint Filler:
1. Expansion Joint Filler Material:
    - a. Design Criteria:
      - 1) Resilient, flexible, non-extruding, expansion-contraction joint filler meeting requirements of ASTM D1751.
      - 2) **1/2 inch (12.7 mm)** thick.
      - 3) Resilience:
        - a) When compressed to half of original thickness, recover to minimum of seventy (70) percent of original thickness.
    - b. Type Two Acceptable Products:
      - 1) Fiber Expansion Joint by W R Meadows, Hampshire, IL [www.wrmeadows.com](http://www.wrmeadows.com).
      - 2) Equal as approved by Architect before installation. See Section 01 6200.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification Of Conditions:
1. Concrete Forms:
    - a. Verify dimensions and spot elevations for locations of forms for concrete footings, stem walls, building slabs, curbs, gutters, walkways, and drainage systems are correct before concrete is placed.
      - 1) Notify Architect of incorrect dimensions or spot elevations in writing.
      - 2) Do not place concrete until corrections are made and verified.

### 3.2 PREPARATION

- A. Concrete Mixing:
1. General:
    - a. All concrete shall be machine mixed.
    - b. Water gauge shall be provided to deliver exact predetermined amount of water for each batch.
    - c. Reliable system must be employed to insure that no less than predetermined amount of cement goes into each batch.
    - d. Re-tempering partly set concrete will not be permitted.
  2. Transit Mix:
    - a. Transit mix concrete may be used provided it conforms to Specifications and tests herein described and ASTM C94/C94M.
    - b. Central plant producing concrete and equipment transporting it are suitable for production and transportation of controlled concrete and plant is currently approved by local state DOT.
    - c. Maximum elapsed time between time of introduction of water and placing shall be one (1) hour.

- d. Minimum time of mixing shall be one (1) minute per cubic yard after all material, including water, has been placed in drum, and drum shall be reversed for an additional two (2) minutes.
  - e. Mixing water shall be added only in presence of Inspecting Engineer or inspector employed by Testing Agency.
  - f. Trucks shall not be overloaded in excess of rated capacity as recommended by manufacturer.
3. Cold Weather Concreting Procedures:
- a. General Requirements:
    - 1) Materials and equipment required for heating and protection of concrete shall be approved and available at Project site before beginning cold weather concreting.
    - 2) Forms, reinforcement, metallic embedments, and fillers shall be free from snow, ice, and frost. Surfaces that will be in contact with newly placed concrete, including sub-grade materials, shall be **35 deg F (2 deg C)** minimum at time of concrete placement.
    - 3) Thaw sub-grade **6 inches (150 mm)** deep minimum before beginning concrete placement. If necessary, re-compact thawed material.
    - 4) Use no frozen materials or materials containing ice.
    - 5) See ACI 306.1 'Standard Specification for Cold Weather Concreting' for additional requirements.
4. Hot Weather Concreting Procedures:
- a. General:
    - 1) Maximum concrete temperature allowed is **90 deg F (32 deg C)** in hot weather.
    - 2) Cool aggregate and subgrades by sprinkling.
    - 3) Avoid cement over **140 deg F (60 deg C)**.
    - 4) Use cold mixing water or ice.
    - 5) Use fog spray or evaporation retardant to lessen rapid evaporation from concrete surface.
    - 6) See ACI 305.1 'Specification for Hot Weather Concreting' for additional requirements.
- B. Surface Preparation:
- 1. Earthwork Preparation:
    - a. Aggregate base and subgrade:
      - 1) Prepare aggregate base as specified in Section 31 1123.
      - 2) Prepare natural soil subgrade as specified in Section 31 2213.
      - 3) Prepare fill subgrade as specified in Section 31 2323.
  - 2. Inserts, bolts, boxes, templates, pipes, conduits, and other accessories required by Divisions 22, 23, and 26 shall be installed and inspected before placing concrete.
  - 3. Install inserts, bolts, boxes, templates, pipes, conduits, and other accessories furnished under other Sections to be installed as part of work of this Section:
    - a. Tie anchor bolts for hold-down anchors and columns securely to reinforcing steel.
- C. Removal:
- 1. Remove water and debris from space to be placed:

### 3.3 INSTALLATION

- A. Placing Concrete:
- 1. General:
    - a. Place as soon after mixing as possible.
    - b. Deposit as nearly as possible in final position.
    - c. No concrete shall be deposited in water.
    - d. Placing of concrete shall be continuous until panel or section is complete.
    - e. Compact concrete in forms by vibrating and other means where required.
      - 1) Thoroughly consolidate concrete around reinforcing bars (Consolidation not required in concrete around reinforcing bars with Mix Type G).
      - 2) Use and type of vibrators shall conform to ACI 309.
    - f. Form vertical surfaces full depth. Do not allow concrete to flow out from under forms in any degree into landscaped areas.
    - g. Consolidate concrete thoroughly.

- h. Do not embed aluminum in concrete.
- i. Do not use contaminated, deteriorated, or re-tempered concrete.
- j. Avoid accumulation of hardened concrete.
- k. Dusting with cement not permitted.
- 2. Exterior Slabs:
  - a. For continuous placing and where shown on Drawings, saw cut **one inch (25 mm)** deep control joints before shrinkage occurs (**2 inches at 6 inch slabs**) (**50 mm at 150 mm slabs**).
- 3. Miscellaneous Concrete Elements:
  - a. Equipment Bases: Coordinate with appropriate Sections for locations and dimensions.
  - b. Mow Strips and Aprons:
    - 1) Aggregate base not necessary under mow strips and aprons.
    - 2) Form and cast mow strips in place.
    - 3) Set top of mow strip above finish grade as follows:
      - a) Sodded Areas: **2 inches (50 mm)** below.
      - b) Seeded Areas: **One inch (25 mm)** below.
      - c) Ground Cover Areas: **2 inches (50 mm)** below.
      - d) Trees and Shrub Areas (not individual trees): **4 inches (100 mm)** below.
    - 4) Compact topsoil underneath mow strips and aprons to density of undisturbed earth.
  - c. Sidewalks, Exterior Stairs, And Landings:
    - 1) Slope with cross slope of **1/8 to 1/4 inch per ft (3 to 6 mm per 300 mm)** (one to two percent) in direction of intended drainage.
    - 2) Slope away from building **1/8 to 1/4 inch per ft (3 to 6 mm per 300 mm)** (one to two percent) minimum.
    - 3) Concrete walks shall be screeded to bring surface to grades and lines as indicated. Surface shall be floated with wood float with no coarse aggregate showing and then given broom finish before concrete sets.
- 4. Joints:
  - a. Control Joints (Contraction Joints):
    - 1) Form control joints with early-entry, dry-cut saws as soon as final trowel operations are complete, and joints can be cut without raveling.
    - 2) Depth of control joints shall be approximately one quarter of concrete slab thickness, but not less than **one inch (25 mm)**.
    - 3) Control joints to be hand tooled in sidewalks, curbs and gutters, mow strips, and aprons.
    - 4) Table One:

Concrete Control Joint On-Center Spacing (+/-)		
Sidewalks	<b>4 feet to 6 feet</b>	<b>1.2 meters to 1.8 meters</b>
Curbs and Gutters	<b>10 feet</b>	<b>3.0 meters</b>
Mow Strips	<b>3 feet to 5 feet</b>	<b>0.90 meters to 1.50 meters</b>
Flat Drainage Structures	<b>10 feet</b>	<b>3 meters</b>
Retaining Walls w/guardrails	Align with posts	
Retaining Walls w/chain link fencing	Align with posts	

- b. Expansion Joints:
  - 1) Install so top of expansion joint material is **1/4 inch (6 mm)** below finished surface of concrete.
  - 2) No expansion joint required between curbs and sidewalks parallel to curb.
  - 3) Provide expansion joints at ends of exterior site concrete elements that are perpendicular to and terminate at curbs, building foundations or other concrete elements (i.e. sidewalks, mow strips, aprons).
  - 4) Provide expansion joints between sidewalks that are parallel, and adjacent, to storage building or main building.
  - 5) Provide expansion joints around perimeter of concrete slab on grade at mechanical enclosure, around perimeter of slab on grade at dumpster enclosure and at top and bottom of exterior stairs.
  - 6) Table Two:

Concrete Expansion Joint (Isolation) On-Center Spacing (+/-)		
Sidewalks, Curbs and Gutters	40 feet to 100 feet	12 meters to 30 meters
Mow Strips and Aprons	20 feet to 40 feet	6 meters to 12 meters
Flat Drainage Structures	50 feet	15 meters
Retaining Walls w/guardrails	36 feet	11 meters
Retaining Walls w/chain link fencing	50 feet	15 meters

- 7) Seal expansion joints as specified in Section 07 9213 for following areas:
  - a) Between entryway slabs and building foundations.
  - b) Between sidewalks and building foundations.
  - c) Within curbs and gutters.
  - d) Within flat drainage structures and at joints between flat drainage structures and other concrete elements.
- 8) Expansion joints are not required to be sealed for following areas:
  - a) Within aprons and where apron abuts sidewalks.
  - b) Within mow strips and where mow strip abuts building foundation and sidewalks.
  - c) Within sidewalks.

B. Finishing:

1. Exterior Concrete Flatwork:

- a. Curb, Gutter, Sidewalks, Mow Strips, Flat Drainage Structures, Stairs, And Miscellaneous:
  - 1) After completion of final floating, performed immediately after screeding and when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:
    - a) Provide fine hair finish where grades are less than 6 percent 1-1/4 inch (32 mm).
    - b) Provide rough hair finish where grades exceed 6 percent 1-1/4 inch (32 mm).
    - c) Broom finish, by drawing broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide fine line texture acceptable to Architect. At curb and gutter, apply broom finish longitudinal to curb and gutter flowline.
    - d) On inclined slab surfaces, provide coarse, non-slip finish by scoring surface with stiff-bristled broom, perpendicular to line of traffic. At curb and gutter, apply broom finish longitudinal to curb and gutter flowline.
    - e) Do not remove forms for twenty-four (24) hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Architect.
    - f) Round edges exposed to public view to 1/2 inch (13 mm) radius, including edges formed by expansion joints.
    - g) Remove edger marks.

C. Curing:

1. Membrane Concrete Curing:

- a. As specified in Section 09 3923 'Membrane Concrete Curing'.
- b. Follow Manufacturer's written instructions for preparation, application rates, placement, and cleanup:
  - 1) Apply as soon as troweling on interior concrete is complete.
  - 2) Apply as soon as brooming or finishing of exterior concrete is complete.
  - 3) Spraying application is required.
  - 4) Do not dilute or thin product.
  - 5) Do not apply when temperature of concrete is less than 40 deg F (4.4 deg C).
  - 6) Apply uniformly without puddles or ponding.
  - 7) Do not apply before bleed water has dissipated.
  - 8) Do not apply over standing water.

D. Tolerances:

1. General:

- a. Maximum Variation Tolerances:

## 1) Table Three:

Maximum Variation Tolerances		
Thickness, standard	plus 3/8 inch, minus 1/4 inch	plus 9.5 mm, minus 3 mm
Thickness, footings	minus 0 inch	minus 0 mm
Plan, 0 - 20 feet	1/2 inch	12.7 mm
Plan, 40 feet or greater	3/4 inch	19 mm
Plan, footings	plus 1/2 inch	plus 12.7 mm
Eccentricity, footings	2 inch maximum standard, 1/2 inch at masonry	50 mm maximum standard, 12.7 mm at masonry
Openings, size	minus 1/4 inch, plus one inch	minus 6 mm, plus 25.4 mm
Openings, location	plus / minus 1/2 inch at center	plus / minus 12.7 mm at center
Plumb	1/2 inch maximum	12.7 mm maximum
Consecutive Steps, treads	1/4 inch	6 mm
Consecutive Steps, risers	1/8 inch	3 mm
Flight of Stairs, treads	1/4 inch in total run	6 mm in total run
Flight of Stairs, risers	1/8 inch in total height	3 mm in total height

**3.4 FIELD QUALITY CONTROL**

## A. Field Tests And Inspections:

1. Civil and structural field tests, laboratory testing, and inspections are provided by Owner's independent Testing Agency as specified in Section 01 4523 'Testing And Inspection Services':
  - a. Quality Control is sole responsibility of Contractor:
    - 1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
      - a) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.
  2. Reinforcement Bars and Bolts:
    - a. Testing Agency shall provide inspections will include following:
      - 1) Bolts:
        - a) Inspection of bolts to be installed in concrete prior to and during placement of concrete.
        - b) Periodic inspection of anchors installed in hardened concrete.
      - 2) Reinforcement Bars:
        - a) Periodic inspection of reinforcement bars and placement prior to concrete placement to verify grade, size, cover, spacing, and position of reinforcing.
        - b) Inspect that all reinforcement bars are be positively identified as to heat number and mill analysis.
        - c) Confirm surface of reinforcing bars is free of form release oil or other deleterious substances.
  3. Concrete:
    - a. Testing Agency shall provide testing and inspection for concrete as per ASTM C1077.
    - b. Testing and inspections, if performed, will include following:
      - 1) Periodic inspection verifying use of required design mix.
      - 2) Inspection of reinforcing bars and anchor bolts before placement of concrete for proper installation.
      - 3) Inspection at time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine temperature of concrete.
      - 4) Inspection of concrete placement for proper application techniques.
        - a) Steel tools are not to be used on exterior concrete.
      - 5) Periodic inspection for maintenance of specified curing temperature and techniques:
        - a) Steel tools are not to be used on exterior concrete. Bull floating and finish floating is to be performed with magnesium or wood floats.
      - 6) Periodic inspect of formwork for shape, location and dimensions of concrete member being formed:

- a) Certified Inspector shall inspect forms for general location, configuration, camber, shoring, sealing of form joints, correct forming material, concrete accessories, and form tie locations.
- 7) Periodic inspection of concrete finishing operations for proper finishing techniques.
- 8) Periodic inspection for placement of specified curing compounds.
- c. Testing Agency will sample and test during placement of concrete as directed by Architect and may include following:
  - 1) Sampling Fresh Concrete: ASTM C172/C172M, except modified for slump to comply with ASTM C94/C94M:
    - a) Slump: ASTM C143/C143M, test each time set of compressive specimens are made.
    - b) Air Content: ASTM C173/C173M, volumetric method for lightweight or normal weight concrete: ASTM C231/C231M, pressure method for normal weight concrete each time set of compression test specimens are made.
    - c) Concrete Temperature: Test each time set of compressive specimens are made.
    - d) Unit Weight: ASTM C567/C567M, test each time set of compressive specimens are made.
  - d. Compression Test Specimen: ASTM C31/C31M, one (1) set of four (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.
  - e. Compressive Strength Tests: ASTM C39/C39M:
    - 1) Obtain one (1) composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd (4 cu m), but less than 50 cu. yd (38 cu m), plus one (1) set for each additional 50 cu. yd (38 cu m) or fraction thereof.
    - 2) One (1) specimen tested at seven (7) days, two (2) specimens tested at twenty-eight (28) days, and one (1) specimen retained in reserve for later testing if required.
    - 3) If strength of field-cured cylinders is less than eighty-five (85) percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing in-place concrete.
    - 4) Strength level of concrete will be considered satisfactory if averages of sets of three (3) consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi (3.45 MPa).
  - f. Samples:
    - 1) Fresh Concrete: ASTM C172/C172M except modified for slump to comply with ASTM C94/C94M.
      - a) Slump: ASTM C143/C43M, test each time set of compressive specimens are made.
      - b) Air Content: ASTM C173/C173M, volumetric method for lightweight or normal weight concrete: ASTM C231/C231M, pressure method for normal weight.
      - c) Concrete Temperature: Test each time set of compressive specimens are made.
      - d) Unit Weight: ASTM C567/C567M, test each time set of compressive specimens are made.
- B. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
  1. Correct any work found defective or not complying with contract document requirements at no additional cost to the Owner.

### 3.5 CLEANING

- A. General:
  1. Curing:
    - a. Clean tools, equipment as directed by Manufacturer's instructions.

**3.6 PROTECTION**

- A. Concrete:
  - 1. Protect concrete that has not received its initial set from precipitation to avoid excess water in mix and unsatisfactory surface finish.
  - 2. Do not allow materials resulting from construction activities, which will affect concrete or application of finish floor systems adversely, to come in contact with interior concrete slabs.
  - 3. Protect interior concrete floors from stains, paint, mortar and other construction activities.
- B. Curing:
  - 1. Restrict foot or vehicle traffic as curing membrane dries as recommended by Manufacturer.

**END OF SECTION**





**SECTION 03 3923****MEMBRANE CONCRETE CURING****PART 1 - GENERAL****1.1 SUMMARY**

- A. Products Furnished But Not Installed Under This Section:
  - 1. Quality of membrane concrete curing as described in Contract Documents.
- B. Related Requirements:
  - 1. Section 03 3111: 'Cast-In-Place Structural Concrete' for application of membrane concrete curing.

**1.2 REFERENCES**

- A. Definitions:
  - 1. Curing: Process by which hydraulic-cement concrete matures and develops hardened properties, over time, as result of continued hydration of cement in presence of sufficient water and heat. Also used to describe action taken to maintain moisture and temperature conditions in freshly placed concrete.
- B. Reference Standards:
  - 1. American Association of State and Highway Transportation Officials:
    - a. AASHTO M 148-05, 'Standard Specification for Liquid Membrane-Forming Compounds for Curing'.
  - 2. ASTM International:
    - a. ASTM C309-11, 'Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete'.

**1.3 SUBMITTALS**

- A. Action Submittals:
  - 1. Product Data:
    - a. Manufacturer's product data.
    - b. Material Safety Data Sheets (MSDS).
- B. Informational Submittals:
  - 1. Manufacturer Instructions:
    - a. Printed installation instructions.

**1.4 QUALITY ASSURANCE**

- A. Regulatory Agency Sustainability Approvals:
  - 1. Comply with applicable VOC standards and other local requirements.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery And Acceptance Requirements:
  - 1. Materials shall be delivered in original, unopened packages with labels intact.

B. Storage And Handling Requirements:

1. Follow Manufacturer's written instructions for handling and storage of product:
  - a. Store in unopened containers in clean, dry area between 35 deg F (2 deg C) and 110 deg F (43 deg C) (Keep from freezing) or as directed by Manufacturer's instruction.
2. Shelf Life: Do not use curing compound that is over one (1) year from manufacturer date.

## 1.6 FIELD CONDITIONS

A. Ambient Conditions:

1. Do not apply curing compound when temperature of concrete is less than 40 deg F (4.4 deg C).

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Membrane Concrete Curing:

1. Description:
  - a. Clear water-based, ready-to use membrane curing agent that cures freshly placed concrete, forming effective barrier against moisture loss from concrete surface.
2. Design Criteria:
  - a. Exterior Concrete:
    - 1) Dissipating or non-dissipating membrane curing agent.
  - b. Interior Concrete:
    - 1) Dissipating membrane curing agent only.
  - c. VOC-compliant compound.
  - d. Meet requirements of ASTM C309 and AASHTO M 148, Type 1 or 1-D, Class B.
  - e. Interior concrete: containing no mineral spirits, naphtha, or other components detrimental to finish flooring installation.
  - f. Maintain ninety-five (95) percent of mix water present in concrete mass after application.
  - g. Gradually dissipate after twenty-eight (28) days without leaving stain or discoloring concrete surface.
3. Horizontal and Vertical Cast-In-Place Structural Concrete:
  - a. Type One Acceptable Products.
    - 1) Exterior Concrete:
      - a) Clear Cure J7WB by Dayton Superior Corporation, Miamisburg, OH [www.daytonsuperior.com](http://www.daytonsuperior.com).
      - b) Clear Water Resin by Right Point, Dekalb, IL [www.rightpointe.com](http://www.rightpointe.com).
      - c) L&M Cure R by L&M Construction Chemicals, Inc. Omaha, NE [www.lmcc.com](http://www.lmcc.com).
      - d) VOCOMP 20 (do not use when concrete sealer will be applied in areas of freeze/thaw and deicer salts) by W.R. Meadows, Inc. Hampshire, IL [www.wrmeadows.com](http://www.wrmeadows.com).
      - e) 1100-Clear by W. R. Meadows, Inc. Hampshire, IL [www.wrmeadows.com](http://www.wrmeadows.com).
    - b. Equal product meeting design criteria requirements as approved by Architect/Owner's Representative before BID. See Section 01 6200.

## PART 3 - EXECUTION: Not Used

END OF SECTION

**DIVISION 05: METALS**

**05 0500 COMMON WORK RESULTS OF METALS**

05 0503 SHOP-APPLIED METAL COATINGS

05 0253 METAL FASTENING

**05 1000 STRUCTURAL METAL FRAMING**

05 1200 STRUCTURAL STEEL FRAMING

**05 3000 METAL DECKING**

05 3110 STEEL DECKING

END OF TABLE OF CONTENTS



**SECTION 05 0503****SHOP-APPLIED METAL COATINGS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Quality of factory or shop-applied priming applied to steel supplied to Project without finish coat.
  - 2. Quality of and procedures for field touch-up and repair of factory-applied priming and galvanizing.
- B. Related Requirements:
  - 1. Sections under 09 9000 heading: Finish painting.

**1.2 REFERENCES**

- A. Reference Standards:
  - 1. ASTM International:
    - a. ASTM A780/A780M-09(2015), 'Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings'.
    - b. ASTM B695-04(2016), 'Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel'.

**1.3 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-Installation Conference:
  - 1. Participate in pre-installation conference.
  - 2. In addition to requirements of Section 01 3100, review following:
    - a. Meet with Architect before commencing repair of galvanized surfaces to establish extent of repairs required and, if applicable, choice of methods to be used.

**1.4 SUBMITTALS**

- A. Action Submittals:
  - 1. Product Data:
    - a. Product data and samples, if requested by Architect.

**PART 2 - PRODUCTS****2.1 FINISHES**

- A. Factory And Shop-Applied Primer:
  - 1. Compatible with and of equal or better quality than finish paint system to be applied by Sections under 09 9000 heading.
  - 2. Primer on unexposed, unfinished surfaces may be fabricator's standard shop coat.
- B. Repairs To Primed Surface:

- C. Unless otherwise specified, use primer which matches characteristics of original primer and is compatible with and of equal or better quality than finish paint system to be applied by Sections under 09 9000 heading.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Surface Preparation:
1. General:
    - a. Clean, grind, or otherwise prepare welds in steel that is to be coated within limits acceptable to welder responsible for structural integrity.
    - b. Surfaces to be coated shall be clean, dry and free of oil, grease, and corrosion products.
  2. Preparation Of Primed, Ungalvanized Surfaces:
    - a. Clean welds and grind serious abrasions.
  3. Preparation Of Galvanized Surfaces:
    - a. Follow requirements of ASTM A780/A780M and following:
    - b. For Repair Using Zinc-Rich Paints:
      - 1) Blast clean surfaces to near-white metal, in accordance with SSPC-SP10 (1 to 2 mil anchor pattern), as minimum.
      - 2) Where circumstances do not allow blast cleaning, power disk sand to bright metal finish.
      - 3) Extend surface preparation into undamaged galvanized area.
      - 4) Remove flux residue and weld spatter from welded areas.
    - c. For Repair Using Zinc-Based Alloys:
      - 1) Clean surface to be reconditioned using wire brush, light grinding action, or mild blasting.
      - 2) Extend surface preparation into surrounding, undamaged galvanized areas.
      - 3) Remove flux residue and weld spatter from welded areas.
      - 4) Preheat cleaned area to at least 600 deg F (316 deg C).
        - a) Do not overheat surface beyond 750 deg F (400 deg C) or allow surrounding galvanized coatings to be burned.
        - b) Wire brush surface during preheating.
    - d. For Repair Using Sprayed Zinc (Metallizing):
      - 1) Blast clean surfaces to near-white metal, in accordance with SSPC-SP5 as minimum.
      - 2) Extend surface preparation into undamaged galvanized area.
      - 3) Remove flux residue and weld spatter from welded areas.

### 3.2 REPAIR / RESTORATION

- A. Repairs To Primed, Ungalvanized Surfaces:
1. Thoroughly clean metal and give one (1) prime coat of specified material, well-worked into metal joints and open spaces. Match existing primed finish as required.
    - a. Do not apply primer at temperatures below 45 deg F (7 deg C).
    - b. Protect un-primed machine-finished surfaces against corrosion by priming.
- B. Repairs To Galvanized Surfaces:
1. Non-Structural, Non-Load-Bearing Items Not Exposed To Weather:
    - a. Repair Using Zinc-Rich Paints: Spray- or brush-apply zinc-rich paint to prepared area. Apply paint in single application employing multiple spray passes to achieve dry film thickness of 2 mils.
  2. Structural, Load-Bearing Items And Items Exposed To Weather:
    - a. Repair Using Zinc-Based Alloys:
      - 1) Rub cleaned, pre-heated areas with repair stick to deposit evenly distributed layer of zinc alloy. If powdered zinc alloys are used, sprinkle powder on surface and spread out with spatula or similar tool.

- 2) Remove flux residue by rinsing with water or wiping with damp cloth.
- b. Repair Using Sprayed Zinc (Metallizing): Apply 2 mil minimum coating by means of metal-spraying pistols fed with either zinc wire or zinc powder in accordance with requirements of ASTM B695, Type I.
3. All Items:
  - a. Apply repair materials immediately after surface preparation is complete.
  - b. Take thickness measurements, with either magnetic or electromagnetic gauge, to ensure applied coating is as specified or agreed to.

**END OF SECTION**





**SECTION 05 0523****METAL FASTENING****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Quality of structural metal-to-metal, wood-to-metal, and wood-to-wood bolts used on Project.
  - 2. Requirements and standards for site welded metal-to-metal connections.
- B. Related Requirements:
  - 1. Furnishing and installing of structural bolts specified under Section concerned.
  - 2. Performance of welding specified under Section concerned.

**1.2 REFERENCES**

- A. Reference Standards:
  - 1. American National Standards Institute / American Welding Society:
    - a. ANSI/AWS D1.1/D1.1M:2015, 'Structural Welding Code - Steel'.
    - b. ANSI/AWS D1.3/D1.3M:2018, 'Structural Welding Code - Sheet Steel'.
  - 2. ASTM International:
    - a. ASTM A307-14, 'Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength'.

**1.3 QUALITY ASSURANCE**

- A. Qualifications: Requirements of Section 01 4301 applies, but not limited to the following:
  - 1. Welders shall be certified 30 days minimum before beginning work on Project. If there is doubt as to proficiency of welder, Architect may require welder to take another test, at no expense to Owner. Certification shall be by Pittsburgh Laboratories or other authority approved by Architect.
- B. Certifications:
  - 1. Maintain welder's certifications on job-site.

**PART 2 - PRODUCTS****2.1 MANUFACTURED UNITS**

- A. Materials:
  - 1. Bolts And Threaded Fasteners:
    - a. Bolts: Conform to requirements of ASTM A307, Grade A.

**2.2 ACCESSORIES**

- A. Arc-Welding Electrodes: Type E70XX AWS Iron and Steel Arc-welding electrodes and meeting current AISC Specifications.

**PART 3 - EXECUTION**

**3.1 PERFORMANCE**

- A. Welding shall meet requirements of ANSI / AWS D1.1 and D1.3.

**END OF SECTION**

**SECTION 05 1200****STRUCTURAL STEEL FRAMING****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install structural steel framing as part of building structure as described in Contract Documents.
- B. Products Furnished But Not Installed Under This Section:
  - 1. Structural anchors, plates, channels, angles, etc, to be cast into concrete.
- C. Related Requirements:
  - 1. Section 03 3111: 'Cast-In-Place Structural Concrete' for installation of structural items to be cast into concrete.

**1.2 REFERENCES**

- A. Association Publications:
  - 1. American Institute of Steel Construction:
    - a. AISC 'Guide to Design Criteria for Bolted and Riveted Joints' (2nd Edition).
    - b. AISC 'Steel Construction Manual' (14th Edition).
- B. Reference Standards:
  - 1. American Concrete Institute:
    - a. ACI 318-14, 'Building Code Requirements for Structural Concrete' (ACI 318) and 'Commentary on Building Code Requirements for Structural Concrete' (ACI 318R).
    - b. ACI 318M-14, 'Building Code Requirements for Structural Concrete (ACI 318M) and Commentary' (ACI 319RM).
  - 2. American Institute of Steel Construction / The Society for Protective Coatings:
    - a. AISC 420-10/SSPC-QP 3, 'Certification Standard for Shop Application of Complex Protective Coating Systems'.
  - 3. American National Standards Institute / American Institute of Steel Construction:
    - a. ANSI/AISC 340-14, 'Specification for Structural Joints using High-Strength Bolts'.
    - b. ANSI/AISC 341-10, 'Seismic Provisions for Structural Steel Buildings'.
    - c. ANSI/AISC 358-10, 'Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications'.
    - d. ANSI/AISC 360-10, 'Specification for Structural Steel Buildings'.
  - 4. American National Standards Institute / American Society for Nondestructive Testing (Following are specifically referenced for Structural Steel testing):
    - a. ANSI/ASNT CP-189-2011, 'Standard for Qualification and Certification of Nondestructive Testing Personnel'.
    - b. ANSI/ASNT SNT-TC-1A-2011, 'Personnel Qualification and Certification in Nondestructive Testing'.
  - 5. American National Standards Institute / American Welding Society (Following are specifically referenced for Structural Steel testing):
    - a. ANSI/AWS D1.1/D1.1M:2015, 'Structural Welding Code - Steel'.
    - b. ANSI/AWS D1.3/D1.3M:2018, 'Structural Welding Code - Sheet Steel'.
    - c. ANSI/AWS D1.4/D1.4M:2018, 'Structural Welding Code - Reinforced Steel'.
  - 6. American Welding Society:
    - a. AWS QC1:2007, 'Standard for AWS Certification of Welding Inspectors'.
  - 7. ASTM International:

- a. ASTM A36/A36M-14, 'Standard Specification for Carbon Structural Steel.'
- b. ASTM A53/A53M-18, 'Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.'
- c. ASTM A435/A435M-17, 'Standard Specification for Straight-Beam Ultrasonic Examination of Steel Plates'.
- d. ASTM A500/A500M-18, 'Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.'
- e. ASTM A992/A992M-11(2015), 'Standard Specification for Structural Steel Shapes.'
- f. ASTM F3125/F3125M-18, 'Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions'.

### 1.3 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Conference:
  1. Participate in pre-installation conference.

### 1.4 SUBMITTALS

- A. Action Submittals:
  1. Product Data:
    - a. Submit product data and samples, if requested by Architect.
  2. Shop Drawings:
    - a. Shop drawings and calculations, prepared and stamped by structural engineer, shall include, but not be limited to, plans, elevations, and large scale details of typical sections, connections, joining, and accessories.
    - b. Show other fabricated work.

### 1.5 QUALITY ASSURANCE

- A. Qualifications. Requirements of Section 01 4301 applies, but is not limited to following:
  1. Fabricator Qualifications:
    - a. Not less than five (5) years experience with similar in size, scope, and installation procedures required for this project.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery And Acceptance Requirements:
  1. Deliver material to job site at such intervals as to insure uninterrupted progress of Work.
  2. Deliver anchor bolts, bearing plates and other items to be set by other Contractors shall be delivered to site in ample time for installation and with templates and/or setting instructions.
- B. Storage And Handling Requirements:
  1. Structural steel shall not be handled until paint has thoroughly dried. Care must be exercised to avoid abrasions and other damage.
  2. Material shall be stocked out of mud and dirt and proper drainage shall be provided. Structural steel must be protected from damage or soiling by adjacent construction operations.

## PART 2 - PRODUCTS

### 2.1 COMPONENTS

- A. Materials:

1. Angles, Channels, and Miscellaneous steel parts of steel framing systems.
    - a. Meet requirements of ASTM A36/A36M.
    - b. S, HP, C, or TEE shapes in horizontal or vertical application, together with angles, plates, etc, as shown on Drawings.
  2. Structural Tubing: Meet requirements of ASTM A500/A500M, Grade B.
- B. Fabrication:
1. Requirements: Structural metal shall be product of domestic mill.
  2. ANSI/AISC 360 shall serve as minimum standard.
  3. Fabricate items to be embedded in concrete or masonry according to approved details of work to be connected.
- C. Finishes: Shop prime structural steel.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verification Of Conditions:
1. Do not begin structural steel framing erection until structural support components have been installed and are in suitable condition to receive framing.

### **3.2 ERECTION**

- A. Special Techniques:
1. Standards:
    - a. AISC's 'Specification for Structural Steel Buildings' and 'Code of Standard Practice for Steel Buildings and Bridges' shall serve as minimum standards. Erection includes setting, aligning, and bracing as necessary.
  2. Do not overload or exceed carrying capacity of any structural steel element during construction period.
  3. Plates or Channels Embedded in Concrete:
    - a. Tack weld bolts to plates or channels to prevent bolts from turning when nuts are tightened.
  4. Immediately after erection, clean completed field connections and damaged surfaces with solvents and hand or power tools. After cleaning, apply corrosion-resistant primer compatible with factory-applied primer.
- B. Interface With Other Work:
1. Furnish items to be embedded in concrete or masonry to Division 03 or 04 respectively in time to be securely tied in place before placing concrete and grout.

### **3.3 FIELD QUALITY CONTROL**

- A. Field Tests And Inspections:
1. Civil and structural field tests, laboratory testing, and inspections are provided by Owner's independent Testing Agency as specified in Section 01 4523 'Testing And Inspection Services':
    - a. Quality Control is sole responsibility of Contractor.
      - 1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
        - a) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.
  2. General Requirements:
    - a. Furnish items to be embedded in concrete or masonry to Division 03 or 04 respectively in time to be securely tied in place before placing concrete and grout.
  3. Structural Steel - General:

- a. Testing Agency shall provide testing and inspection of structural steel including following:
- 1) Mill Certificates:
    - a) Mill certificates or affidavits and manufacturer's certification shall be supplied to inspector for verification of steel materials.
    - b) Testing laboratory shall be notified at least three (3) weeks in advance of fabrication and supplied with reports so that shop inspection may be performed.
  - 2) General Inspection:
    - a) Testing Agency shall be at fabricator's plant to verify that materials used match mill tests or affidavits of test reports; that fabrication, welding procedures, surface preparation, and shop painting meet specifications; and that work in progress conforms to project requirements.
    - b) Testing Agency shall visually check fabricated steel delivered to job to confirm that work is in compliance with approved shop drawings and shall make any physical tests, measurements, etc., believed to be necessary.
    - c) Testing Agency shall witness and report all corrections performed by steel fabricator occurring on fabricator's own initiative.
  - 3) Bolting Requirements: All inspection shall conform to requirements of current edition of AISC 340, 'Specification for Structural Joints using High-Strength Bolts' using F3125/F3125M Grade A325 and Grade A490 Bolts:
    - a) Miscellaneous Metal: Where miscellaneous angles, channels, studs, and similar shapes are detailed for support of major components of work, welds, bolts, and material are subject to same testing requirement as other structural supporting members.
    - b) Inspections shall include required verification and inspection of steel construction as referenced in IBC Section 17 'Special Inspections And Tests' and in accordance with ANSI/AISC 360 and applicable ASTM material standards, and ANSI/AISC 360, Section M2.5. Periodic and continuous inspections include:
      - (1) Material verification of high-strength bolts, nuts and washers:
        - (a) Identification markings to conform to AWS designation listed in WPS (periodic).
        - (b) Manufacturer's certificated of compliance required (periodic).
      - (2) Inspection of high-strength bolting:
        - (a) Snug-tight joints.
        - (b) Pretensioned and slip-criteria joints using turn-of-nut with match marking, twist-off bolt or direct tension indicator methods of installation (periodic).
        - (c) Pretension and slip-critical joints using turn-of-nut without match marking or calibrated wrench methods of installation (continuous).
  - 4) Welding Requirements: Inspection shall be provided by Testing Agency for all welding in accordance with Building Code:
    - a) Nondestructive testing shall be performed as required by Building Code and ANSI/AWS D1.1/D1.1M as specified herein for all shop and field welds.
    - b) Ultrasonically test 100 percent of all complete penetration welds and 100 percent of all partial-penetration column splice welds.
    - c) Ultrasonically test all joints where base metal is thicker than 1-1/2 inches (38 mm), when subjected to through-thickness weld shrinkage strains. Joint shall be ultrasonically inspected for discontinuities directly behind such welds after joint completion.
    - d) When ultrasonic indications arising from weld root cannot be interpreted as either weld defect or backing strip itself, backing strip shall be removed at expense of Contractor, and if no root defect is visible, weld shall be re-tested. If no defect is indicated on this re-test, and no significant amount of weld metal has been removed, no further repair of welding is necessary. If defect is indicated, it shall be repaired at no expense to Owner.
    - e) Perform Magnetic Particle (MP) tests of fillet welds larger than 5/16 inch (8 mm).
    - f) Exceptions:
      - (1) When approved by Owner's Representative and/or Architect/Engineer, rate of testing for ultrasonic testing of complete-penetration welds may be reduced in accordance with following:

- (a) Nondestructive testing rate for individual welder or welding operator may be reduced to 25 percent, provided reject rate is demonstrated to be 5 percent or less of welds tested for welder or welding operator. Sampling of at least 40 completed welds for job shall be made for such reduction evaluation. Reject rate is defined as number of welds containing rejectable defects divided by number of welds completed).
- (b) For complete penetration groove welds on materials less than 5/16 inch (8 mm) thick, nondestructive testing is not required provided continuous inspection is provided.
- (c) When approved by building official, nondestructive ultrasonic testing may be performed in shop of AISC approved fabricator utilizing qualified test techniques in employment of fabricator.
- (2) Other ultrasonic or magnetic particle testing may be reduced by approval of Owner's Representative and/or Architect/Engineer upon presentation of satisfactory documentation submitted by Contractor.
- (3) There shall be no exceptions to testing requirements for SFRS.
- g) Inspections shall include required verification and inspection of steel construction as referenced in IBC Section 17 'Special Inspections And Tests' and in accordance with ANSI/AISC 360, Section A3.5 and applicable ANSI/AWS A5 documents, ANSI/AWS D1.1/D1.1M, ANSI/AWS D1.3/D1.3M, ANSI/AWS D1.4/D1.4M, and ACI 318 or ACI 318M, Section 3.5.2. Periodic and continuous inspections include:
  - (1) Material verification of weld filler materials:
    - (a) Identification markings to conform to AWS designation listed in WPS (periodic).
    - (b) Manufacturer's certificated of compliance required (periodic).
  - (2) Inspection of welding:
    - (a) Structural steel and cold-formed steel deck:
      - (i) Complete and partial joint penetration groove welds (continuous).
      - (ii) Multipass fillet welds (continuous).
      - (iii) Single-pass fillet welds > 5/16 inch (8 mm) (continuous).
      - (iv) Plug and slot welds (continuous).
      - (v) Single-pass fillet welds ≤ 5/16 inch (8 mm) (periodic).
- 5) Steel Frame Requirements:
  - a) Inspections shall include required verification and inspection of steel frame as referenced in IBC Section 17 'Special Inspections And Tests' and in accordance with ANSI/AISC 360 and Applicable ASTM material standards. Periodic inspections include:
    - (1) Inspection of steel frame joint details compliance with approved construction documents:
      - (a) Details such as bracing and stiffening (periodic).
      - (b) Member locations (periodic).
      - (c) Applications of joint details at each connection (periodic).

**END OF SECTION**





**SECTION 05 3110****STEEL DECKING****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
1. Furnish and install floor decking as described in Contract Documents including but not limited to:
    - a. Composite steel decking as required for concrete slab construction, including all headed stud anchors, closures, decking support angles at columns, reinforcing, and all accessories as may be required for complete and properly erected installation.
- B. Related Requirements:
1. Section 01 1200: Multiple contracts.
  2. Section 01 3100: 'Project Management and Coordination' for pre-installation conference.
  3. Section 01 4000: 'Quality Requirements' for administrative and procedural requirements for quality assurance and quality control.
  4. Section 01 4301: 'Quality Assurance – Qualifications' establishes minimum qualification levels required.
  5. Section 01 7800: 'Closeout Submittals'.

**1.2 REFERENCES**

- A. Association Publications:
1. Council of American Structural Engineers. CASE Form 101: *Statement of Special Inspections*. Washington, DC: CASE, 2001. (c/o American Council of Engineering Companies, 1015 15<sup>th</sup> St., NW, Washington, DC 20005; 202-347-7474; [www.acec.org](http://www.acec.org)).
  2. Federal Emergency Management Agency: FEMA 353, '*Recommended Specifications and Quality Assurance Guidelines for Steel Moment-Frame Construction for Seismic Applications*'. 500 C Street Southwest Washington, DC, [www.fema.gov](http://www.fema.gov).
- B. Definitions (Following are specifically referenced for testing):
1. Accreditation: Process in which certification of competency, authority, or credibility is presented. Verify that laboratories have an appropriate quality management system and can properly perform certain test methods (e.g., ANSI, ASTM, and ISO test methods) and calibration parameters according to their scopes of accreditation.
  2. Approved: To authorize, endorse, validate, confirm, or agree to.
  3. Field Quality Control: Testing, Inspections, Special Testing and Special Inspections to assure compliance to Contract Documents.
  4. Inspection/Special Inspection: Inspection of materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with approved construction documents and referenced standards:
    - a. Inspection: Not required by code provisions but may be required by Contract Documents.
    - b. Special Inspection: Required by code provisions and by Contract Documents.
    - c. Inspection-Continuous: Full-time observation of the Work requiring inspection by approved inspector who is present in area where the Work is being performed.
    - d. Inspection-Periodic: Part-time or intermittent observation of the Work requiring inspection by approved inspector who is present in area where the Work has been or is being performed and at completion of the Work.
  5. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform particular construction operation, including installation, erection, application, and similar operations.

6. Observation: Visual observation of building / site elements or structural system by registered design professional for general conformance to approved construction documents at significant construction stages and at completion. Observation does not include or waive responsibility for performing inspections or special inspections.
  7. Owner's Representative: Owner's Designated Representative (Project Manager or Facilities Manager) who will have express authority to bind Owner with respect to all matters requiring Owner's approval or authorization.
  8. Preconstruction Testing: Tests and inspections that are performed specifically for Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
  9. Product Testing: Tests and inspections that are performed by testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
  10. Quality Assurance: Testing, Inspections, Special Testing and Special Inspections provided for by Owner.
  11. Quality Control: Testing, Inspections, Special Testing and Special Inspections provided for by Contractor.
  12. Service Provider: Agency or firm qualified to perform required tests and inspections.
  13. Source Quality Control Testing: Tests and inspections that are performed at source, i.e., plant, mill, factory, or shop.
  14. Special Inspection: See Inspection.
  15. Special Inspector: Certified individual or firm that implements special inspection program for project.
  16. Special Test: See Test.
  17. Test/Special Test: Field or laboratory tests to determine characteristics and quality of building materials and workmanship.
    - a. Test: Not required by code provisions but may be required by Contract Documents.
    - b. Special Test: Required by code provisions and by Contract Documents.
  18. Testing Agency: Entity engaged to perform specific tests, inspections, or both.
  19. Testing Agency Laboratory: Agency or firm qualified to perform field and laboratory tests to determine characteristics and quality of materials and workmanship.
  20. Verification: Act of reviewing, inspecting, testing, etc. to establish and document that product, service, or system meets regulatory, standard, or specification requirements.
- C. Reference Standards:
1. American Concrete Institute:
    - a. ACI 318-14, 'Building Code Requirements for Structural Concrete and Commentary'.
  2. American National Standards Institute / American Institute of Steel Construction:
    - a. ANSI/AISC 360-16, 'Specification for Structural Steel Buildings'.
    - b. ANSI/AISC S200-12, 'North American Standard for Cold-Formed Steel Framing - General Provisions'.
  3. American National Standards Institute / American Welding Society (Following are specifically referenced for Structural Steel testing):
    - a. ANSI/AWS D1.1/D1.1M:2015, 'Structural Welding Code - Steel'.
    - b. ANSI/AWS D1.3/D1.3M:2010, 'Structural Welding Code - Sheet Steel'.
    - c. ANSI/AWS D1.4/D1.4M:2018, 'Structural Welding Code - Reinforced Steel'.
  4. American National Standard Institute / Steel Deck Institute:
    - a. ANSI/SDI C-2017, 'Standard for Composite Steel Floor Deck – Slabs'.
    - b. ANSI/SDI NC-2017, 'Non-Composite Steel Floor Deck'.
    - c. ANSI/SDI QA/QC-2017, 'Quality Control and Quality Assurance for Installation of Steel Deck'.
    - d. ANSI/SDI RD-2017, 'Standard for Steel Deck'.
    - e. ANSI/SDI T-CD-2017, 'Test Standard for Composite Steel Deck - Slabs'.
  5. American Society for Nondestructive Testing (Following are specifically referenced for Structural Steel testing):
    - a. ASNT CP-189-2016, 'Standard for Qualification and Certification of Nondestructive Testing Personnel'.
    - b. ASNT SNT-TC-1A-2016, 'Standard Topical Outlines for Qualification of Nondestructive Testing Personnel'.
  6. American Welding Society:

- a. AWS QC1:2007, 'Standard for AWS Certification of Welding Inspectors'.
- 7. ASTM International:
  - a. ASTM A36/A36M-14, 'Standard Specification for Carbon Structural Steel'.
  - b. ASTM A108-18, 'Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished'.
  - c. ASTM A653/A653M-18, 'Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process'.
  - d. ASTM A1008/A1008M-18, 'Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable'.
- 8. International Code Council (IBC) (2018 or most recent edition adopted by AHJ):
  - a. IBC Chapter 17, 'Structural Tests and Special Inspections'.
- 9. Research Council on Structural Connections (RCSC):
  - a. 'RCSC Specification for Structural Joints Using High-Strength Bolts' (2014).
- 10. Steel Deck Institute:
  - a. Design Manual for Composite Decks, Form Decks, Roof Decks' No. 31 (2007).
  - a. MOC3, 'SDI Manual of Construction with Steel Deck' (2016 Edition 3).

### 1.3 SUBMITTALS

- A. Action Submittals:
  - 1. Product Data:
    - a. Provide Manufacturer's cut sheets including, but not limited to, dimensions of individual components, profiles, and finishes.
  - 2. Shop Drawings:
    - a. Show location and layout of steel decking panels, anchorage details, and other information required for thorough review.
    - b. Show type and configuration of steel decking.
    - c. Show component parts of steel decking, indicating welds, connection requirements, reinforcing, closures, and related components.
- B. Informational Submittals:
  - 1. Certificates:
    - a. Welding certificates.
  - 2. Qualification Statements:
    - a. Fabricator / Inspector / Welder:
      - 1) Provide Qualification documentation.

### 1.4 QUALITY ASSURANCE

- A. Regulatory Agency Sustainability Approvals:
  - 1. Structural adequacy of decking sections shall be established in accordance with methods set forth in ANSI/AISC S200. The "moment" and deflection coefficient used shall be in accordance with Steel Deck Institute's recommendations. Steel decking shall sustain all dead loads plus live loads.
- B. Qualifications. Requirements of Section 01 4301 applies, but is not limited to following:
  - 1. Fabricator Qualifications:
    - a. Qualified Fabricator who participates in AISC Quality Certification Program and is designated AISC-Certified Plant, Category Sbd.
      - 1) Submit documentation.
  - 2. Inspector Qualifications:
    - a. All inspectors shall be trained and competent in accordance with quality assurance plan in Section 01 4523.
    - b. Non-destructive testing Personnel Qualifications:
      - 1) NDT personnel shall be qualified under either ANSI/ASNT CP-189 or ANSI/ASNT SNT-TC-1A..

- 2) Ultrasonic Testing (UT) shall be performed only by certified ASNT Level III technicians or by certified ASNT Level II technicians acting under direct supervision of ASNT Level III technician.
  - 3) Technicians who perform flaw detection or sizing shall be trained in applicable procedures and authorized to operate in jurisdiction in which Project is located and shall demonstrate their competence through testing as prescribed in FEMA 353 Appendix E for all connections that are part of SFRS.
- c. Welding Inspector Qualifications:
- 1) All Welding Inspectors shall meet qualification as set forth in ANSI/AWS D1.1/D1.1M.
  - 2) For welds in SWD Categories A and B, Welding Inspectors shall be AWS Certified Welding Inspectors (CWI) or Senior Certified Welding Inspectors (SCWI) as defined in AWS QC1 'Standard for AWS Certification of Welding Inspectors'.
  - 3) Submit documentation.
3. Welder Qualifications:
- a. Provide documentation certifying welders have met AWS qualifications within previous twelve (12) months.
  - b. Submit documentation.
- C. Testing and Inspection:
1. Owner will provide Testing and Inspection for inspection of steel decking:
    - a. Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
      - 1) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery And Acceptance Requirements:
1. Protect steel decking panels from corrosion, deformation, and other damage during delivery and handling.
- B. Storage And Handling Requirements:
1. Protect steel decking panels from corrosion, deformation, and other damage during storage, and handling.
  2. If ground storage is required, store bundles of steel deck panels off ground with one end elevated to provide drainage.
  3. Protect bundles from condensation with ventilated waterproof covering.
  4. Stack bundles to prevent material damage.

## PART 2 - PRODUCTS

### 2.1 SYSTEM

- A. Manufacturers:
1. Type One Acceptable Manufacturer:
    - a. Any current member of Steel Deck Institute.
    - b. Equal as approved by Architect before bidding. See Section 01 6200.
- B. Design Criteria:
1. Steel Decking:
    - a. Steel decking panels shall be composite decking when supporting concrete. Decking shall be 3 inch (76 mm) deep, 18 ga (0.0478 in) (1.3106 mm) type W3 steel decking unless otherwise noted on Contract Drawings and shall be galvanized, G60 and formed from steel conforming to ASTM A653/A653M, Grade 40.
  2. Headed Stud Anchors:
    - a. Design Criteria:

- 1) Headed stud anchors shall be **3/4 inch (19 mm)** diameter conforming to requirements of ASTM A108 for cold finished carbon steel bars and shafting, Grades 1015-1020.
- 2) Headed stud anchors shall have minimum tensile strength of **60,000 psi (420 MPa)** and yield strength of not less than **50,000 psi (345 MPa)**.

C. Material:

1. Steel Decking:
  - a. Welding:
    - 1) Including all welding required properly fabricating and erecting steel decking.
    - 2) Shop welding (2) or more units together is not allowed.
    - 3) Spot Welds:
      - a) Spot welds shall be made using resistance spot-welders with electronic timers and heat controls, with uniformly applied pressure, and incorporating slope and temper controls to properly anneal welds.
2. Hanger Tabs on Decking:
  - a. Furnish hanger tabs in place to receive suspended ceiling construction.
  - b. Tabs shall be piercing type with load capacity of not less than **250 lbs (113 kg)** per tab location.
  - c. Lip tabs shall receive hole in lower end to receive hangers by others and shall be placed in side joints (between units) on not more than two (2) foot centers in two (2) directions. Tabs shall be not less than **18 ga (0.0478 in) (1.3106 mm)** in thickness.
  - d. Tab Limitations: Provide limitations of hanger tabs documentation with Submittal Documentation.
3. Closures and Flashings:
  - a. Furnish and weld in place all sheet metal closures and fillers as required to close between floor units and columns, beams and girders, ends of runs, and in all other locations where shown and noted (or not shown, but required for proper installation) on Construction Drawings. Include metal flashing wherever shown.
  - b. Gauges: Except as otherwise indicated on Contract Drawings, closures and fillers shall be not less than **18 ga (0.0478 in) (1.3106 mm)** in thickness; flashings not less than **12 ga (0.1084 in) (2.7534 mm)**.
  - c. Provide decking support steel meeting requirements of ASTM A36/A36M. Sizes of steel angles shall be in accordance with details at columns appearing on Structural Drawings.
4. Headed Stud Anchors:
  - a. Size and dimension:
    - 1) Headed stud anchors after welding, shall have length of **5-1/2 inches (140 mm)** as required by Contract Drawings.
    - 2) Headed stud anchor heads shall be **1-1/4 inch (32 mm)** in diameter with minimum **3/8 inch (9.5 mm)** depth.
  - b. Headed stud anchors shall be complete with ferrules compatible with decking used.
  - c. Headed stud anchors shall be of uniform diameter, and heads shall be concentric and normal to shaft.
  - d. After welding, headed stud anchors shall be free from any substance or defects which would interfere with its function as a headed stud anchors.
  - e. Headed stud anchors shall remain unpainted and not galvanized.

## 2.2 ACCESSORIES

- A. Continuous edge closures, closure plates, end closures, flashing and related components to properly prepare decking to receive concrete, and welding of all such work, as required.
- B. Filler plates as may be required to close gaps between decking and structural concrete.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification Of Conditions:
1. Examine support framing and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work of this Section.
  2. Notify Architect of unsuitable conditions in writing.
  3. Do not install decking over unsuitable conditions.
  4. Commencement of Work by installer is considered acceptance of substrate.

### 3.2 PREPARATION

- A. Surface Preparation:
1. Locate bundles to prevent overloading of support members.
  2. Hoisting: Provide hoisting of all materials required to be furnished and installed.

### 3.3 INSTALLATION

- A. General:
1. Installation of steel decking shall closely follow erection of structural steel framing.
  2. Install steel decking in accordance with Steel Deck Institute 'Design Manual for Composite Decks, Form Decks, Roof Decks' and as shown on placement drawings, and as specified.
  3. All steel decking shall be erected in accordance with manufacturer's standard methods.
- B. Coordinate With Other Trades:
1. It shall be understood that certain portions of steel decking installation may be delayed in order that other trades may complete their work in proper sequence.
- C. Erection:
1. Steel decking panels shall be placed with edges up and flutes at right angles to structural steel supports.
  2. End laps shall always occur over supporting members. Minimum end lap shall be **2 inch (50 mm)**. Panels shall be lapped not less than 1/2 flute at side laps and welded at **3 feet (0.90 m)** on center. Panels shall be attached to top flange of steel beam supports by plug welding.
- D. Welding:
1. Unless otherwise noted on the structural drawings, end laps shall be fastened using weld washer at each side lap plus one intermediate weld (three welds per sheet).
  2. At intermediate supports weld sheets at side laps at each such support.
- E. Alignment and Span:
1. Floor unit shall be placed in straight alignment for the entire length of run of peaks and valleys.
- F. Steel Decking:
1. Steel decking shall be placed on supporting steel frame work and adjusted to final position before being permanently fastened.
  2. Each decking piece shall span across minimum of two (2) spans.
  3. Cut and neatly fit decking units and accessories around openings and other work projecting through or adjacent to decking.
  4. Structural Supports:
    - a. Place decking panels on structural supports and adjust to final position with ends aligned. If structural supports are not in proper alignment, or at proper level, notify Architect/Engineer (in writing) for corrective action which must be made before placing steel decking units.
    - b. Install decking ends over supports with minimum end bearing **2 inches (50 mm)**. Minimum side lap of one corrugation.

- c. Attach steel decking firmly to supports immediately after placement.
  5. After panels have been placed and aligned, they shall be immediately welded to supporting steel.
- G. Holes and Openings:
1. Description:
    - a. Holes: Any aperture cut through steel floor decking in unframed areas to accommodate sleeves for pipes, ducts, conduits.
    - b. Openings: Apertures through steel decking such as openings for stairs, shafts, and framing of which will be furnished and installed under this Structural Steel Contract, as indicated on the Construction Drawings. Such structural steel framing shall provide adequate support with minimum bearing of **3 inches (76 mm)**, unless otherwise shown.
  2. Cutting of Openings:
    - a. Cut and neatly fit decking units and accessories around openings and other work projecting through or adjacent to decking.
    - b. Do not cut unscheduled openings through decking without approval of Architect/Engineer. Reinforce openings as shown on Contract Drawings or as directed by Architect/Engineer.
    - c. Steel decking shall be cut as required to fit pre-determined holes and structural steel framed openings as shown, located, and dimensioned on Contract Drawings:
      - 1) Other than predetermined holes, all holes required by other trades shall be provided by trades requiring holes. Cutting shall be performed as hereinafter specified.
      - 2) Provide shop and field cutting of steel decking as required to provide sufficient clearance for brackets and the Work of other trades and all coping and welding of such members.
    - d. Reinforcing for Openings and Holes:
      - 1) Reinforcing required for all openings and holes passing through steel decking shall be furnished and installed under this specification regardless of which Trade holes have been cut.
      - 2) Furnish and install in all locations where support of floor units has not been provided by steel framing, sufficient reinforcement and support decking. Such support and reinforcing shall meet Engineer of Record's approval.
      - 3) All holes and openings cut through steel decking shall be reinforced except that holes **6 inch (150 mm)** or less in diameter, and holes in which distance cut across a flute is **6 inch (150 mm)** or less, need not be reinforced, provided adjacent holes are not closer than **30 inches (762 mm)** on center.
      - 4) Required reinforcing shall be **14 ga (0.0785 in) (1.9939 mm)** sheet steel and **4 inch (100 mm), 5.4 lbs (2.45 kg)**. steel channels respectively as shown and noted on Contract Drawings.
      - 5) All welds shall be minimum of **3/4 inch (19 mm)** in length and spaced not more than **8 inch (200 mm)** on center.
- H. Headed Stud Anchors:
1. Headed stud anchors shall be installed immediately following the placement and fastening of steel decking, but shall not be installed on wet decking units or structural steel.
  2. Length: Length and spacing of headed stud anchors shall be as specified on Contract Drawings.
  3. Clean steel removing, dirt, water, rust, oil, and any other material which may interfere with welding operations.
  4. Minimum power settings for headed stud anchor welding shall be as follows:
    - a. Time: 65 cycles.
    - b. Current: 1500 amperes.
  5. When headed stud anchor welding operations are interrupted or when welding failure occurs, settings shall be checked and reset, if necessary.
  6. Source of welding power for headed stud anchors shall consist of single generator either electrically or diesel powered with rated output of not less than 2,000 amperes. Multiples of electric or gasoline driven welding generators may be used if properly paralleled to provide required 2,000 ampere output.
  7. Headed stud anchor welding hand tool shall have one-piece molded plastic body designed so that arc-length may be adjusted as required. Welding timer-contractor shall be capable of maintaining weld duty cycle of at least ten **3/4 inch (19 mm)** diameter or eight **1/8 inch (3 mm)** diameter welds per minute, and shall not require separate electrical activating source.



8. Headed stud anchors shall not be installed without ferrules. After welding in place of headed stud anchors, ferrules shall be removed.
- I. Accessories:
  1. Closures:
    - a. Fasten column closures and cell closures to provide tight fitting closures at open ends of ribs and sides of decking.
    - b. Closures shall be fastened in place by tack welding not more than 4 feet (1.20 m) on center for end closures and not more than 3 feet (0.90 m) on center for side closures.
    - c. Provide rubber closer gaskets wherever partition will terminate against decking.
  2. Fasten pour stops and girder fillers to supporting structure according to Manufacturer's written recommendations and as shown on Contract Drawings.
  3. Painting: Provide all touchup painting required for weld areas and damaged surfaces of steel decking and accessory items.

### 3.4 FIELD QUALITY CONTROL

- A. Field Inspections:
  1. General:
    - a. Owner is responsible for Quality Assurance. Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor.
    - b. Quality Control is sole responsibility of Contractor as specified in Section 01 4523 'Testing And Inspection Services'.
    - c. Before placement, inspect metal deck for tears, dents, or other damage that may prevent deck from performing as tight and substantial form.
- B. Non-Conforming Work:
  1. Repair or replace damaged steel decking panels as required at no additional cost to Owner.

**END OF SECTION**

**DIVISION 06: WOOD, PLASTICS, AND COMPOSITES**

**06 0500 COMMON WORK RESULTS OF WOOD, PLASTICS, AND COMPOSITES**

06 0573 PRESERVATIVE WOOD TREATMENT

**06 1000 ROUGH CARPENTRY**

06 1011 WOOD FASTENINGS

06 1100 WOOD FRAMING

**06 2000 FINISH CARPENTRY**

06 2001 COMMON FINISH CARPENTRY REQUIREMENTS

06 2210 MISCELLANEOUS WOOD TRIM

END OF TABLE OF CONTENTS



**SECTION 06 0573****PRESERVATIVE WOOD TREATMENT****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Quality of wood preservative treatment where specified.
- B. Related Requirements:
  - 1. Section 06 1100:
    - a. Characteristics of wood to be pressure-treated.
    - b. Furnishing and installing of pressure-treated wood.

**1.2 REFERENCES**

- A. Definitions:
  - 1. Preservative-Treated Wood: Wood exposed to high levels of moisture or heat susceptible to decay by fungus and other organisms, and to insect attack. The damage caused by decay or insects can jeopardize the performance of the wood members so as to reduce the performance below that required. Preservative treatment requires pressure-treatment process to achieve depth of penetration of preservative into wood to verify that the wood will be resistant to decay and insects over time.
  - 2. Treated Wood: Wood impregnated under pressure with compounds that reduce its susceptibility to flame spread or to deterioration caused by fungi, insects, or marine bores.
- B. Reference Standards:
  - 1. American Wood Protection Association:
    - a. AWPA P5-10. 'Standard For Waterborne Preservatives'.
    - b. AWPA P22-10. 'Standard For Ammoniacal Copper Zinc Arsenate (ACZA)'.
    - c. AWPA P51-10, 'Standard for Zinc Borate (ZB)'.
    - d. AWPA T1-12, 'Use Category System: Processing and Treatment Standard For Treated Wood'.
    - e. AWPA U1-12, 'Use Category System: User Specification For Treated Wood'.
  - 2. International Building Code (IBC) (2018 or most recent edition adopted by AHJ):
    - a. Chapter 23, 'Wood':
      - 1) Section 2300, 'Minimum Standards and Quality':
        - a) 2303.1, 'General':
          - (1) 2303.1.8, 'Preservative-Treated Wood'.
      - 2) Section 2400, 'General Construction Requirements':
        - a) 2304.11, 'Protection Against Decay and Termites':
          - (1) 2311.2, 'Wood Used Above Ground'.
          - (2) 2311.4, 'Wood In Contact With The Ground'.

**1.3 SUBMITTALS**

- A. Informational Submittals:
  - 1. Certificate: Certificate of pressure treatment showing compliance with specification requirements and including information required under IBC Section 2303.1.8.1, 'Identification'.

**PART 2 - PRODUCTS****2.1 SYSTEMS****A. Manufacturers:****1. Type One Acceptable Manufacturers:**

- a. Arch Wood Protection Inc, Atlanta, GA [www.wolmanizedwood.com](http://www.wolmanizedwood.com).
- b. Hoover Treated Wood Products, Thomson, GA [www.frtw.com](http://www.frtw.com).
- c. Osmose Inc, Griffin, GA [www.osmose.com](http://www.osmose.com).
- d. U S Borax Inc, Valencia, CA [www.borax.com/wood](http://www.borax.com/wood).
- e. Viance LLC, Charlotte, NC [www.treatedwood.com](http://www.treatedwood.com).
- f. Equal as approved by Architect before bidding. See Section 01 6200.

**B. Performance:**

1. Framing lumber grade and species shall be as specified in Section 06 1100 for particular use.
2. Interior Wood In Contact With Concrete or Masonry:
  - a. Preservatives:
    - 1) Disodium octoborate tetrahydrate (DOT / SBX) meeting requirements of AWPA U1 and with retention of **0.25 lbs per cu ft (4 kg per cu meter)**.
    - 2) Zinc borate meeting requirements of AWPA U1 and with retention of **0.17 lbs per cu ft (2.7 kg per cu meter)**.
    - 3) CCA-C (47.5 percent chromium trioxide, 18.5 percent copper oxide and 34 percent arsenic pentoxide) by Koppers Performance Chemicals, Griffin, Georgia, <http://www.koppersperformancechemicals.com/> (0.25 lb/cu ft minimum retention).
    - 4) DURA-GUARD by Hoover Treated Wood Products, Thomson, GA [www.frtw.com](http://www.frtw.com) (.40 lb/cu ft minimum retention).
  - b. Lumber: Treat in accordance with AWPA U1.
3. Exterior Wood Continuously Exposed To Weather:
  - a. Preservatives: Waterborne preservatives meeting requirements of AWPA U1 with retention levels as required by AWPA U1 for specific application.
  - b. Lumber: Treat in accordance with AWPA U1.

**PART 3 - EXECUTION: Not Used****END OF SECTION**

**SECTION 06 1011****WOOD FASTENINGS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Quality of wood fastening methods and materials used for Rough Carpentry unless specified otherwise.
- B. Related Requirements:
  - 1. Furnishing and installing of other fasteners are specified in individual Sections where installed.

**1.2 REFERENCES**

- A. Reference Standards;
  - 1. ASTM International:
    - a. ASTM A153/A153M-16a, 'Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware'.
    - b. ASTM D3498-18, 'Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems'.
    - c. ASTM F1667-18a, 'Standard Specification for Driven Fasteners: Nails, Spikes, and Staples'.

**1.3 SUBMITTALS**

- A. Action Submittals:
  - 1. Product Data:
    - a. Manufacturer's literature on framing anchors and powder actuated fasteners.
  - 2. Shop Drawings:
    - a. Submit diameter and lengths of fasteners proposed for use on Project. If length or diameter of proposed fasteners differ from specified fasteners, also include technical and engineering data for proposed fasteners including, but not limited to:
      - 1) Adjusted fastener spacing where using proposed fasteners and,
      - 2) Adjusted number of fasteners necessary to provide connection capacity equivalent to specified fasteners.
    - b. Submit on powder-actuated fasteners other than those specified in Contract Documents showing design criteria equivalents at each application.
    - c. Show type, quantity, and installation location of framing anchors. Where necessary, reference Drawing details, etc, for installation locations.

**PART 2 - PRODUCTS****2.1 MANUFACTURED UNITS**

- A. Description:
  - 1. Nail Terminology:
    - a. When following nail terms are used in relation to this Project, following lengths and diameters will be understood. Refer to nails of other dimensions by actual length and diameter, not by one of listed terms:

Nail Term	Length	Diameter	Length	Diameter
8d Box	2-1/2 inches	0.113 inch	63.5 mm	2.827 mm
8d Common	2-1/2 inches	0.131 inch	63.5 mm	3.389 mm
10d Box	3 inches	0.128 inch	76.2 mm	3.251 mm
10d Common	3 inches	0.148 inch	76.2 mm	3.759 mm
16d Box	3-1/2 inches	0.135 inch	88.9 mm	3.411 mm
16d Sinker	3-1/4 inches	0.148 inch	82.6 mm	3.759 mm
16d Common	3-1/2 inches	0.162 inch	88.9 mm	4.115 mm

B. Materials:

1. Wood fastener list:
  - a. Provide VMR Suppliers with wood fastener list.
2. Fasteners:
  - a. General:
    - 1) Fasteners for preservative treated and fire-retardant-treated wood shall be of hot dipped zinc-coated galvanized steel, stainless steel, silicon bronzed, or copper. Coating weights for zinc-coated fasteners shall be in accordance with ASTM A153/A153M.
  - b. Nails:
    - 1) Meet requirements of ASTM F1667.
    - 2) Unless noted otherwise, nails listed on Drawings or in Specifications shall be common nail diameter, except 16d nails, which shall be box diameter.
  - c. Wood Screws:
    - 1) SDS Screws:
      - a) Category Four Approved Products. See Section 01 6200 for definitions of categories.
        - (1) SDS Screws by Simpson Strong Tie Co, Dublin, CA [www.strongtie.com](http://www.strongtie.com).
      - 2) All Other: Standard type and make for job requirements.
  - d. Powder-Actuated Fasteners:
    - 1) Type One Quality Standard: Hilti X-DNI 62P8.
    - 2) Manufacturers:
      - a) Hilti, Tulsa, OK [www.us.hilti.com](http://www.us.hilti.com).
      - b) Redhead Division of ITW, Wood Dale, IL [www.itw-redhead.com](http://www.itw-redhead.com) and Markham, ON [www.itwconstruction.ca](http://www.itwconstruction.ca).
      - c) Equals as approved by Architect through shop drawing submittal before installation. See Section 01 6200.
3. Adhesives:
  - a. Construction Mastics:
    - 1) Meet requirements of 'APA-The Engineered Wood Association' Specification AFG-01 or ASTM D3498.
    - 2) Use phenol-resorcinol type for use on pressure treated wood products.
4. Framing Anchors:
  - a. Framing anchors and associated fasteners in contact with preservative hot dipped zinc-coated galvanized steel or stainless steel. Do not use stainless steel items with galvanized items.
  - b. Type Two Acceptable Products:
    - 1) KC Metals Inc, San Jose, CA [www.kcmetals.com](http://www.kcmetals.com).
    - 2) Simpson Strong Tie Co, Dublin, CA [www.strongtie.com](http://www.strongtie.com).
    - 3) United Steel Products Co Inc (USP), Montgomery, MN [www.uspconnectors.com](http://www.uspconnectors.com).
    - 4) Equals as approved by Architect through shop drawing submittal before installation. See Section 01 6200.

## PART 3 - EXECUTION

### 3.1 ERECTION

- A. Secure one Manufacturer approved fastener in each hole of framing anchor that bears on framing member unless approved otherwise in writing by Architect.

- B. Provide washers with bolt heads and with nuts bearing on wood.

**END OF SECTION**





**SECTION 06 1100****WOOD FRAMING****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install wood framing and blocking as described in Contract Documents.
- B. Products Installed But Not Furnished Under This Section:
  - 1. Miscellaneous structural steel elements.
  - 2. Roof related blocking, wood nailers, and curbs.
  - 3. Structural composite lumber.
- C. Related Requirements:
  - 1. Section 05 1223: 'Structural Steel For Buildings' for furnishing of miscellaneous structural steel.
  - 2. Section 06 0573: 'Preservative Wood Treatment' for quality of preservative wood treatment.

**1.2 REFERENCES**

- A. Association Publications:
  - 1. American Lumber Standard Committee (ALSC) (Maintains NIST standard):
    - a. Voluntary Product Standard:
      - 1) PS 20-15, 'American Softwood Lumber Standard'.
  - 2. National Institute of Standards and Technology (NIST), U. S. Department of Commerce:
    - a. Voluntary Product Standard DOC PS 20-15, 'American Softwood Lumber Standard'.

**1.3 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-Installation Conference:
  - 1. Participate in MANDATORY pre-installation conference held jointly with Section 06 1636.
    - a. Schedule pre-installation conference immediately before beginning framing work.
    - b. In addition to agenda items specified in Section 01 3100, review following:
      - 1) Equipment and gypsum board blocking in wood framed walls.
      - 2) Nails and nailing requirements.
      - 3) Connections.

**1.4 SUBMITTALS**

- A. Informational Submittals:
  - 1. Test And Evaluation Reports:
    - a. Technical and engineering data on nails to be set by nailing guns for Architect's approval of types proposed to be used as equivalents to specified hand set nails and adjusted number and spacing of pneumatically-driven nails to provide equivalent connection capacity.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery And Acceptance Requirements:
  - 1. Protect lumber and sheathing and keep under cover in transit and at job site.
  - 2. Do not deliver material unduly long before it is required.

- B. Storage And Handling Requirements:
1. Store lumber and sheathing on level racks and keep free of ground to avoid warping.
  2. Stack to insure proper ventilation and drainage.

## PART 2 - PRODUCTS.

### 2.1 MATERIALS

- A. Dimension Lumber:
1. Design Criteria:
    - a. Meet requirements of PS 20 and National Grading Rules for softwood dimension lumber.
    - b. Bear grade stamp of WWPA, SPIB, or other association recognized by American Lumber Standards Committee identifying species of lumber by grade mark or by Certificate of Inspection.
    - c. Lumber **2 inches (50 mm)** or less in nominal thickness shall not exceed 19 percent in moisture content at time of fabrication and installation and be stamped 'S-DRY', 'K-D', or 'MC15'.
    - d. Preservative Treated Plates / Sills:
      - 1) **2x4 (38 mm by 64 mm)**: Standard and better Douglas Fir, Southern Pine, or HemFir, or StrandGuard by iLevel by Weyerhaeuser Boise, ID [www.ilevel.com](http://www.ilevel.com). (LSL 1.3 E)
      - 2) **2x6 (38 mm by 140 mm)** And Wider: No. 2 or or MSR 1650f - 1.5e Douglas Fir, Southern Pine, HemFir, or StrandGuard by iLevel by Weyerhaeuser, Boise, ID [www.ilevel.com](http://www.ilevel.com). (LSL 1.3 E).
- B. Posts, Beams, And Timbers **5 Inches by 5 Inches (125 mm by 125 mm)** And Larger:
1. Design Criteria:
    - a. No. 1 or better Douglas Fir or Southern Pine.
- C. Lumber Ledgers:
1. Design Criteria:
    - a. No. 2 Douglas Fir-Larch, or Southern Pine.
- D. See Contract Drawings for additional requirements.

### 2.2 ACCESSORIES

- A. Blocking:
1. Sound lumber without splits, warps, wane, loose knots, or knots larger than **1/2 inch (13 mm)**.
- B. Furring Strips:
1. Utility or better.
- C. Sill Sealer:
1. Closed-cell polyethylene foam, **1/4 inch (6 mm)** thick by width of plate.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General:
1. Use preservative treated wood for wood members in contact with concrete or masonry, including wall, sill, and ledger plates, door and window subframes and bucks, etc.
- B. Interface With Other Work:

1. Coordinate with other Sections for location of blocking required for installation of equipment and building specialties. Do not allow installation of gypsum board until required blocking is in place.
2. Where manufactured items are to be installed in framing, provide rough openings of dimensions within tolerances required by manufacturers of such items. Confirm dimensions where not shown on Contract Drawings.

C. Tolerances:

1. Walls:
  - a. 1/4 inch (6 mm) in 20 feet (6 meters), non-cumulative in length of wall.
  - b. 1/8 inch (3 mm) in 10 feet (3 meters) with 1/4 inch (6 mm) maximum in height of wall.
  - c. Distances between parallel walls shall be 1/4 inch (6 mm) maximum along length and height of wall.

D. Walls:

1. Openings: Single, bearing stud supporting header and one adjacent (king) stud continuous between top and bottom plates, unless shown otherwise.
2. Corners And Partition Intersections: Triple studs.
3. Top Plates In Bearing Partitions: Doubled or tripled and lapped. Stagger joints at least 48 inches (1 200 mm).
4. Stud Walls To Masonry. Use one of the following methods:
  - a. Connect with 1/2 inch (13 mm) machine bolts 6 inches (150 mm) from top, 6 inches (150 mm) from bottom, and 48 inches (1 200 mm) maximum on center. Use three bolts minimum in height of 6 foot (1 800 mm) or higher wall.
  - b. Secure wood to masonry using continuous 1/4 inch (6 mm) minimum bead of construction adhesive and powder actuated fasteners installed at 32 inches (800 mm) on center minimum.
5. Sill Plates:
  - a. Shear Walls And Bearing Walls:
    - 1) Provide specified anchor 12 inches (300 mm) maximum and 4 inches (100 mm) minimum from each end of each plate.
    - 2) Shear Walls: Fasten with anchor bolts embedded in concrete or with screw anchors.
    - 3) Bearing Walls: Fasten with anchor bolts embedded in concrete, or with screw anchors or expansion bolts in drilled holes.
  - b. Non-Structural Walls: Fasten with powder actuated fasteners.
  - c. In addition to requirements of paragraphs 'a' and 'b' above, set sill plates of interior walls measuring less than 36 inches (900 mm) in length in solid bed of specified construction adhesive, except where sill sealer is used.
  - d. Install specified seal sealer under sill plates of exterior walls of main building and of acoustically insulated interior walls.
  - e. Masonry Wall Plates:
    - 1) Anchor 2x6 and 2x8 wall plates to top of block walls with 5/8 inch (16 mm) diameter anchor bolts at 32 inches (800 mm) on center unless noted otherwise.
    - 2) Set plates on masonry bearing walls true and level to provide full bearing. Use mortar as specified in Division 04 for leveling if leveling is required.
6. Posts And Columns:
  - a. Unless shown otherwise, nail members of multiple member columns together with 16d at 6 inches (150 mm) on center from each side.
7. Beams And Girders:
  - a. Built-Up Members:
    - 1) Stagger individual members of multiple span beams and girders so, over any one support, no more than half the members will have a joint. In all cases, however, joints shall occur over supports.
    - 2) Unless shown otherwise on Drawings, nail two-ply built-up members with 10d nails 12 inches (300 mm) on center top and bottom, staggered on opposite sides. Nail three-ply built-up members with 16d nails at 12 inches (300 mm) on center, top and bottom, staggered, on opposite sides. Set with crown edge up with full bearing at ends and intermediate supports.
  - b. Pre-Fabricated Members:
    - 1) Solid glu-lam, LVL, LSL, or PSL members may be used in place of built-up 2x (38 mm) framing members. Size shall be same as built-up member.

- 2) Solid LVL or PSL members may be used in place of built-up LVL members. Size shall be same as sum of built-up members.
  - c. Wood shims are not acceptable under ends.
  - d. Do not notch framing members unless specifically shown in Drawing detail.
8. Nailing:
- a. Stud to plate (coordinate with Contract Drawings):

2 by 4 inch nominal	38 by 89 mm	End nail, two 16d OR toe nail, four 8d
2 by 6 inch nominal	38 by 140 mm	End nail, three 16d OR toe nail, four 8d
2 by 8 inch nominal	38 by 184 mm	End nail, four 16d OR toe nail, six 8d
2 by 10 inch nominal	38 by 235 mm	End nail, five 16d OR toe nail, six 8d
1-3/4 by 5-1/2 inch LVL	44 by 140 mm LVL	End nail, three 16d OR toe nail, four 8d
1-3/4 by 7-1/4 inch LVL	44 by 184 mm LVL	End nail, four 16d OR toe nail, six 8d
1-3/4 by 9-1/4 inch LVL	44 by 235 mm LVL	End nail, five 16d OR toe nail, six 8d
1-3/4 by 11-1/4 inch LVL	44 by 286 mm LVL	End nail, six 16d OR toe nail eight 8d

- b. Top plates: Spiked together, 16d, 16 inches (400 mm) on center.
  - c. Top plates: Laps, lap members 48 inches (1200 mm) minimum and nail with 16d nails 4 inches (100 mm) on center
  - d. Top plates: Intersections, three 16d.
  - e. Backing And Blocking: Three 8d, each end.
  - f. Corner studs and angles: 16d, 16 inches (400 mm) on center.
- E. Roof And Ceiling Framing:
- 1. Place with crown side up at 16 inches (400 mm) on center unless noted otherwise.
  - 2. Install structural blocking and bridging as necessary and as described in Contract Documents.
  - 3. Special Requirements:
    - a. Roof And Ceiling Joists: Lap joists 4 inches (100 mm) minimum and secure with code approved framing anchors.
    - b. Roof Rafters And Outlookers:
      - 1) Cut level at wall plate and provide at least 2-1/2 inches (64 mm) bearing where applicable. Spike securely to plate with three 10d nails.
      - 2) Attach to trusses or other end supports with framing anchors described in Contract Documents.
      - 3) Provide for bracing at bearing partitions.
  - 4. Installation of Structural Composite Lumber:
    - a. Install temporary horizontal and cross bracing to hold members plumb and in safe condition until permanent bracing is installed.
    - b. Install permanent bracing and related components before application of loads to members.
  - 5. Secure headers and header backing to structure as described in Contract Documents.
- F. Accessory / Equipment Mounting And Gypsum Board Back Blocking (nailers) for Wood Framing):
- 1. Furnish and install blocking in wood framing required for hardware, specialties, equipment, accessories, and mechanical and electrical items, etc.
- G. Furring Strips:
- 1. On Wood or Steel: Nail or screw as required to secure firmly.
    - a. Ceiling:
      - 1) Attach furring strips to the underside of structural elements with #8 wood screws, of length to penetrate wood framing 1 inch (25 mm) minimum.
  - 2. On Concrete or Masonry:
    - a. Back up furring strips on exterior walls or walls in contact with earth with 15 lb (6.8 kg) felt strip.
    - b. Nail at 12 inches (300 mm) on center maximum.

**END OF SECTION**

**SECTION 06 2001****COMMON FINISH CARPENTRY REQUIREMENTS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install sealants required for items installed under this Section, as described in Contract Documents.
  - 2. Furnish and install following items as described in Contract Documents:
- B. Products Installed But Not Furnished Under This Section:
  - 1. Architectural Woodwork.
  - 2. Chair Rails.
  - 3. Miscellaneous Wood Trim.
  - 4. Selected Equipment.
  - 5. Wood Trim at ceilings.
  - 6. Miscellaneous as specified elsewhere.
- C. Related Requirements:
  - 1. Section 06 1100: 'Wood Framing' for furring and blocking.
  - 2. Section 06 2210: 'Miscellaneous Wood Trim'.
    - a. Wood Trim.
  - 3. Section 07 9213: 'Elastomeric Joint Sealants' for quality of sealants, submittal and installation requirements.

**1.2 REFERENCES**

- A. Association Publications:
  - 1. Architectural Woodwork Institute / Architectural Woodwork Manufacturers Association of Canada / Woodwork Institute, 46179 Westlake Drive, Suite 120, Potomac Falls, VA [www.awinet.org](http://www.awinet.org).
    - a. Architectural Woodwork Standards (AWS), 2nd Edition, 2014.
- B. Definitions:
  - 1. Grade: Unless otherwise noted, this term means Grade rules for Economy, Custom, and/or Premium Grade:
    - a. Economy Grade: The lowest acceptable grade in both material and workmanship requirements, and is for work where price outweighs quality considerations.
    - b. Custom Grade: Typically specified for and adequately covers most high-quality architectural woodwork, providing a well-defined degree of control over a project's quality of materials, workmanship, or installation.
    - c. Premium Grade: The highest Grade available in both material and workmanship where the highest level of quality, materials, workmanship, and installation is required.

**PRODUCTS****1.3 MATERIALS**

- A. Manufacturers:
  - 1. Manufacturer Contact List:
    - a. Blum Inc, Stanley, NC [www.blum.com](http://www.blum.com).
    - b. Bommer Industries, Landrum, SC [www.bommer.com](http://www.bommer.com).
    - c. CompX National, Mauldin, SC [www.nclnet.com](http://www.nclnet.com).
    - d. Dow Chemical, Midland, MI [www.dow.com](http://www.dow.com).

- e. Flynn & Enslow, San Francisco, CA [www.flynnenslow.com](http://www.flynnenslow.com).
- f. Grass America Inc, Kernersville, NC [www.grassusa.com](http://www.grassusa.com).
- g. Hafele America Co., Archdale, NC [hafele.com](http://hafele.com).
- h. Hillside Wire Cloth Co., Inc., Bloomfield, NJ [www.hillsidewirecloth.com](http://www.hillsidewirecloth.com).
- i. Ives, Indianapolis, IN [www.iveshardware.com](http://www.iveshardware.com).
- j. Knape & Vogt, Grand Rapids, MI [www.knapeandvogt.com](http://www.knapeandvogt.com) or Knape & Vogt Canada, Mississauga, ON (905) 676-8972.
- k. Olympus Lock Co, Seattle, WA [www.olympus-lock.com](http://www.olympus-lock.com).
- l. Owens Corning, Toledo, OH [www.owens-corning.com](http://www.owens-corning.com).
- m. Salice America Inc, Charlotte, NC [www.saliceamerica.com](http://www.saliceamerica.com).
- n. SOSS Door Hardware (Division of Universal Industrial Products Company) Pioneer OH [www.soss.com](http://www.soss.com).
- o. Stanley, New Britain, CT [www.stanleyhardware.com](http://www.stanleyhardware.com) or Oakville, ON (800) 441-1759.
- p. TWP Inc., Berkley, CA [www.twpinc.com](http://www.twpinc.com).
- q. Wire Cloth Manufacturers Inc., Mine Hill, NJ [www.wireclothman.com](http://www.wireclothman.com).

B. Glue: Waterproof and of best quality.

## **PART 2 - EXECUTION**

### **2.1 EXAMINATION**

- A. Verification Of Conditions:
  - 1. Verify walls, ceilings, floors, and openings are plumb, straight, in-line, and square before installing Architectural Woodwork.
  - 2. Report conditions that are not in compliance to Architect before starting installation.

### **2.2 PREPARATION**

- A. Surface Preparation:
  - 1. Install Architectural Woodwork after wall and ceiling painting is completed in areas where Architectural Woodwork is to be installed.
- B. Items Installed But Not Furnished Under This Section: Install in accordance with requirements specified in Section furnishing item.

### **2.3 INSTALLATION**

- A. Special Techniques:
  - 1. AWS Custom Grade is minimum acceptable standard, except where explicitly specified otherwise, for installation of architectural woodwork.
- B. General Architectural Woodwork Installation:
  - 1. Fabricate work in accordance with measurements taken on Project site.
  - 2. Scribe, miter, and join accurately and neatly to conform to details.
  - 3. Exposed surfaces shall be machine sanded, ready for finishing.
  - 4. Allow for free movement of panels.
  - 5. Countersink nails. Countersink screws and plug those exposed to view.
- C. Installation for Accessories:
- D. Items Installed But Not Furnished Under This Section: Install in accordance with requirements specified in Section furnishing item.

**END OF SECTION**

**SECTION 06 2210****MISCELLANEOUS WOOD TRIM****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
1. Furnish and install wood trim not specified elsewhere as described in Contract Documents.

**1.2 REFERENCES**

- A. Association Publications:
1. Architectural Woodwork Institute / Architectural Woodwork Manufacturers Association of Canada / Woodwork Institute, 46179 Westlake Drive, Suite 120, Potomac Falls, VA [www.awinet.org](http://www.awinet.org).
    - a. Architectural Woodwork Standards (AWS), 2nd Edition, 2014.
- B. Definitions:
1. Grade: Unless otherwise noted, this term means Grade rules for Economy, Custom, and/or Premium Grade:
    - a. Custom Grade: Typically specified for and adequately covers most high-quality architectural woodwork, providing a well-defined degree of control over a project's quality of materials, workmanship, or installation.
  2. Plain-Sawn: A hardwood figure developed by sawing a log lengthwise at a tangent to the annual growth rings. It appears as U-shaped or straight markings in the board's face.

**1.3 SUBMITTALS**

- A. Action Submittals:
1. Samples:
    - a. Interior Hardwood for Transparent Finish:
      - 1) Before performing work of this Section, prepare Control Sample, to match sample available from Owner, to be used as finishing standard for interior clear finished hardwood as specified in Section 09 9324.
      - 2) Design Criteria:
        - a) Provide **8 inch by 10 inch (200 mm by 255 mm)** sample of Red Oak to match Owner provided stain color selected for Project.
        - b) Control Sample will be used as performance standard for evaluating finish provided.
- B. Informational Submittals:
1. Source Quality Control Submittals:
    - a. Samples:
      - 1) Interior Hardwood for Transparent Finish:
        - a) Owner will provide Control Sample for finish.

**PART 2 - PRODUCTS****2.1 MATERIALS**

- A. Design Criteria:



1. Opaque Finished Hardwood: Hardwood allowed by AWS Custom Grade.
2. Opaque Finished Softwood: Solid stock Pine, C or better, S4S.

## **2.2 SOURCE QUALITY CONTROL**

### **A. Inspections:**

1. Clear Finished Hardwood:
  - a. Color matches Owner provided sample specified in Section 09 9324.

## **PART 3 - EXECUTION: Not Used**

**END OF SECTION**

**DIVISION 07: THERMAL AND MOISTURE PROTECTION**

**07 2000 THERMAL PROTECTION**

07 2116 BLANKET INSULATION

07 2119 FOAMED-IN-PLACE INSULATION

**07 3000 STEEP SLOPE ROOFING**

07 3113 ASPHALT SHINGLES

07 3113 ASPHALT SHINGLES

**07 8000 SMOKE AND FIRE PROTECTION**

07 8400 FIRESTOPPING

**07 9000 JOINT PROTECTION**

07 9213 ELASTOMERIC JOINT SEALANTS

07 9219 ACOUSTICAL JOINT SEALANTS

END OF TABLE OF CONTENTS



**SECTION 07 2116****BLANKET INSULATION****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
1. Furnish and install faced thermal and acoustic batt insulation as described in Contract Documents.
  2. Furnish and install unfaced thermal insulation in ceilings as described in Contract Documents.

**1.2 REFERENCES**

- A. Reference Standards:
1. ASTM International:
    - a. ASTM C665-17, 'Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing'.

**1.3 QUALITY ASSURANCE**

- A. Regulatory Agency Sustainability Approvals:
1. Insulation shall be manufactured and installed in compliance with International Building Code (IBC) or other applicable building codes.

**PART 2 - PRODUCTS****2.1 SYSTEMS**

- A. Manufacturers:
1. Insulation:
    - a. Type One Acceptable Manufacturers:
      - 1) Certainteed Corp, Valley Forge, PA [www.certainteed.com](http://www.certainteed.com).
      - 2) FiberTEK, Salt Lake City, UT [www.fibertekinsulation.com](http://www.fibertekinsulation.com).
      - 3) Guardian Fiberglass, Greer, SC [www.guardianbp.com](http://www.guardianbp.com).
      - 4) Johns Manville, Denver, CO [www.jm.com](http://www.jm.com).
      - 5) Knauf Fiber Glass, Shelbyville, IN [www.knaufusa.com](http://www.knaufusa.com).
      - 6) Owens-Corning Fiberglass Corporation, Toledo, OH [www.owens-corning.com](http://www.owens-corning.com).
      - 7) Thermafiber, Wabash, IL [www.thermafiber.com](http://www.thermafiber.com).
    - b. Equal as approved by Architect before bidding. See Section 01 6200.
- B. Materials:
1. Thermal And Acoustic Insulation:
    - a. Order insulation by 'R' value rather than 'U' value, rating, or thickness, either 16 or 24 inches (400 or 600 mm) wide according to framing spacing.
    - b. Faced Insulation:
      - 1) Kraft faced meeting requirements of ASTM C665, Type II, Class C.
      - 2) Foil faced meeting requirements of ASTM C665, Type III.
        - a) Class A: Exposed insulation.
        - b) Class B: Enclosed insulation.
    - c. Unfaced Insulation: Meet requirements of ASTM C665, Type I.

- 1) Support at trussed rafters:
  - a) Provide support at trussed rafters where insulation is not enclosed by structure or drywall.
  - b) Provide stings/wires which run perpendicular to framing and attach at each trussed rafter and to framing at **32 inches (800 mm)** O.C. minimum and where batt ends adjoin each other.
  - or
  - c) Class Two Quality Standard: Simpson Strong Tie IS Insulation Supports with **14 gauge (1.89 mm)** carbon steel, spring wire and mitered tips for **16 inch (400 mm)** O.C. and **24 inch (610 mm)** O.C. spacing.
- d. 'R' Value Required:
  - 1) Acoustically Insulated Ceilings:
    - a) Enclosed Spaces: Fill framed cavity with batt of appropriate thickness.
    - b) Unenclosed Spaces: R-19.
    - c) Unenclosed Spaces above Offices and Restrooms: R-30.
  - 2) Thermally Insulated Ceilings / Roof:
    - a) R-38C Cathedral / High Density: At 2x12 (**50x300 mm**) Overbuild Framing.
    - b) R-38 Standard: All Other. (R-49 in Climate Zones 6, 7, and 8).
  - 3) Wood Wall Stud Framing:

R-11	<b>3-1/2 inches deep</b>	<b>89 mm deep</b>
R-19	<b>5-1/2 inches deep</b>	<b>140 mm deep</b>
R-25	<b>7-1/4 inches deep</b>	<b>184 mm deep</b>
R-30	<b>9-1/4 inches deep</b>	<b>235 mm deep</b>
R-38	<b>11-1/4 inches deep</b>	<b>286 mm deep</b>

- 4) Structural Composite Lumber (SCL) Wall Framing:

R-11	<b>3-1/2 inches deep</b>	<b>89 mm deep</b>
R-19	<b>5-1/2 inches deep</b>	<b>140 mm deep</b>
R-25	<b>7-1/4 inches deep</b>	<b>184 mm deep</b>
R-30	<b>9-1/2 inches deep</b>	<b>241 mm deep</b>
R-38	<b>11-7/8 inches deep</b>	<b>302 mm deep</b>

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General:
  1. Leave no gaps in insulation envelope.
  2. If two layers of insulation are used to attain required 'R' value, only layer towards interior of building shall have facing.
  3. Provide minimum clearance around recessed lighting fixtures as approved by local code.
- B. In Framing:
  1. Install insulation behind plumbing and wiring, around duct and vent line penetrations, and in similar places.
  2. Fit ends of batts snug against top and bottom plates.
  3. Fit batts snug against stud framing at each side.

**END OF SECTION**

**SECTION 07 3113****ASPHALT SHINGLES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install Asphalt Shingle Roofing System as described in Contract Documents.
- B. Related Requirements:
  - 1. Division 22: Plumbing vent piping.
  - 2. Division 23: HVAC flues and air piping.
- C. Products Installed But Not Furnished Under This Section:
  - 1. Pipe and flue roof jacks.

**1.2 REFERENCES**

- A. Definitions:
  - 1. Flame Spread Classification: Categories as per ASTM E84/UL 723 or CAN/ULC-S102:
    - a. Class A: Highest fire-resistance rating for roofing as per ASTM E108. Indicated roofing is able to withstand severe exposure to fire exposure to fire originating from sources outside building.
    - b. Class B: Fire-resistance rating indicating roofing materials are able to withstand moderate exposure to fire originating from sources outside of building.
    - c. Class C: Fire-resistance rating indicating roofing materials are able to withstand light exposure to fire originating from sources outside of building.
  - 2. Wind Uplift: Wind-induced forces on roof system or components in roof system. Wind uplift generally includes negative pressure component caused by wind being deflected around and across surfaces of building and positive pressure component from air flow beneath roof deck.
- B. Reference Standards:
  - 1. ASTM International:
    - a. ASTM D226-09/D226M-17, 'Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing'.
    - b. ASTM D1970/D1970M-18, 'Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection'.
    - c. ASTM D3018/D3018M-11(2017), 'Standard Specification for Class A Asphalt Shingles Surfaced with Mineral Granules'.
    - d. ASTM D3019/D3019M-17, 'Standard Specification for Lap Cement Used with Asphalt Roll Roofing, Non-Fibered, Asbestos-Fibered, and Non-Asbestos-Fibered'.
    - e. ASTM D3161/D3161M-16a, 'Standard Test Method for Wind-Resistance of Asphalt Shingles (Fan-Induced Method)'.
    - f. ASTM D3462/D3462M-16, 'Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules'.
    - g. ASTM D4869/D4869M-16a, 'Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing'.
    - h. ASTM D7158/D7158M-17, 'Standard Test Method for Wind Resistance of Asphalt Shingles (Uplift Force/Uplift Resistance Method)'.
    - i. ASTM E84-18b, 'Standard Test Method for Surface Burning Characteristics of Building Materials'.
    - j. ASTM E108-17, 'Standard Test Methods for Fire Tests of Roof Coverings'.
    - k. ASTM F1667-18, 'Standard Specification for Driven Fasteners: Nails, Spikes, and Staples'.

2. International Building Code (IBC) (2018 Edition or latest edition adopted by AHJ):
  - a. Chapter 15, 'Roof Assemblies And Rooftop Structures'.
3. National Fire Protection Association:
  - a. NFPA 101: 'Life Safety Code' (2015 Edition).
4. Underwriters Laboratories (UL):
  - a. UL 580: 'Tests for Uplift Resistance of Roof Assemblies' (5th Edition).
  - b. UL 723, 'Tests for Safety Test for Surface Burning Characteristics of Building Materials' (11th Edition).
  - c. UL 790, 'Standard Test Methods for Fire Tests of Roof Coverings' (8th Edition).
  - d. UL 2218, 'Standard for Impact Resistance of Prepared Roof Covering Materials' (2nd Edition).

### 1.3 SUBMITTALS

- A. Action Submittals:
  1. Product Data:
    - a. Color and style selection.
- B. Informational Submittals:
  1. Certificates:
    - a. Installers:
      - 1) Provide current Certification for completion of certified training from Shingle Manufacturer.
      - 2) Installer's signed certificate stating roofing system complies with Contract Documents performance requirements and work only performed by trained and authorized personnel in those procedures.
  2. Reports:
    - a. Manufacturer's test reports.
    - b. Wind speed coverage for warranted wind speed.
    - c. High wind reports and approvals if required by AHJ.
  3. Manufacturers' Instructions:
    - a. Shingle Manufacturer's installation instructions and details for installation of secondary underlayment at penetrations, dormers, eaves, rakes, etc, to fit environmental conditions at Project.
  4. Qualification Statement:
    - a. Installer:
      - 1) Asphalt Shingles:
        - a) Provide Qualification documentation.
- C. Closeout Submittals:
  1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    - a. Warranty Documentation:
      - 1) Asphalt Shingles:
        - a) Final, executed copy of 'Roof Installer Workmanship Warranty' including required Owner mandatory information.

### 1.4 QUALITY ASSURANCE

1. Impact Resistance:
  - a. Meet UL 2218 impact resistant testing.
  - b. Meet UL 2218 Class 4 impact resistant rating for hail.
2. Wind Resistance:
  - a. Meet ASTM D3161/D3161M for wind resistance.
    - 1) Installation shall comply with IBC Table 1507.2.7, 'Attachment'.
3. Wind Speed:
  - a. As required to meet local codes having jurisdiction.
4. Wind Uplift Resistance:
  - a. Meet UL 580 wind uplift of roof assemblies.

- b. Meet UL 1897 uplift test for roof covering systems.
  - c. Meet ASTM D7158/D7158M for wind resistance for uplift force/uplift resistance.
- B. Qualifications:
1. Manufacturer:
    - a. Asphalt Shingles:
      - 1) Asphalt shingles are required to be produced under quality control program administered by inspection agency currently accredited by ICBO ES or recognized by National Evaluation Service, Inc. Quality control manual developed in consultation with approved agency, and complying with ICBO ES Acceptance Criteria for Quality Control Manuals (AC10), must be submitted.
    - b. Underlayment:
      - 1) Underlayment is required to be manufactured under approved quality control program with inspections by inspection agency accredited by International Accreditation Service (IAS) or otherwise acceptable to ICC-ES.
      - 2) Quality documentation complying with ICC-ES Acceptance Criteria for Quality Documentation (AC10) shall be submitted for roof underlayment.
  2. Roof Installer Foreman Qualifications:
    - a. Requirements of Section 01 4301 applies but not limited to the following:
      - 1) Provide documentation if requested by Architect.
        - a) Approved and authorized by Roofing Manufacturer to install Manufacturer's product and eligible to receive Manufacturer's warranty before bid.
        - b) Completed Shingle Manufacturer's certified trained.
        - c) Have thorough knowledge of installing asphalt shingle roofing and have minimum of five (5) years roofing experience.
        - d) Current license for the city, county, and state where project is located and license for specific type of roofing work to be performed.
        - e) Roofing Installer's foreman shall be skilled in his trade and qualified to lay out and supervise the Work.
        - f) Flashing installation shall be performed by personnel trained and authorized by Roofing Manufacturer.
  3. Roof Installer:
    - a. Provide 'Roof Installer Workmanship Warranty' as specified in Warranty in Part 1 of this specification.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery And Acceptance Requirements:
1. Make no deliveries to job site until installation is about to commence, or until approved storage area is provided.
  2. Deliver products job site in Manufacturer's original unopened containers or wrappings with labels intact and legible bearing all seals and approvals.
  3. Deliver materials in sufficient quantities to allow continuity of work.
  4. Remove any material not approved from job site.
- B. Storage And Handling Requirements:
1. Storage Requirements:
    - a. Follow Manufacturer's instructions and precautions for storage and protection of materials.
    - b. Protect roof materials from physical damage, moisture, soiling, and other sources in a clean, dry, protected location.
    - c. Stacking:
      - 1) Shingles: Bundles should be stacked flat.
      - 2) Underlayment:
        - a) Do not double-stack pallets.
        - b) Stack rolls upright until installation.
    - d. Temperature:
      - 1) Shingles:
        - a) Store in covered ventilated area at maximum temperature of 110 deg F (43 deg C).



- b) Use extra care in handling shingles when temperature is below 40 deg F (4.4 deg C).
- 2) Underlayment: Store in area with temperature between 40 deg F and 100 deg F (4.4 deg C and 38 deg C).
- e. Unacceptable Material:
  - 1) Remove from job site materials that are determined to be damaged by Architect or by Roofing Manufacturer and replace at no additional cost to Owner.
- 2. Handling Requirements:
  - a. Handle rolled goods to prevent damage to edge or ends.
- 3. Roof Top Loading:
  - a. Lay shingle bundles flat.
  - b. Do not bend over ridge.

## 1.6 FIELD CONDITIONS

- A. Ambient Conditions:
  - 1. General:
    - a. Proceed with installation only when existing and forecasted weather conditions permit roofing to be performed according to manufacturer's written instructions and warranty requirements.
  - 2. Shingles:
    - a. Do not install shingles at lower temperatures than allowed by Shingle Manufacturer for application.
  - 3. Underlayment:
    - a. Install self-adhering sheet underlayment within range of ambient and substrate temperatures recommended by manufacturer.

## 1.7 WARRANTY

- A. Special Warranty:
  - 1. Shingle Manufacturer's initial warranty to remain in place and not be voided out with the installation of the additional roof penetrations.
  - 2. Standard Wind Areas:
    - a. The original roofing system blow-offs resistance in winds up to 110 mph (177 kph) for ten (10) years from the original installation will be maintained as per specified below.
    - b. Meet requirements of ASTM D3161/D3161M UL Class D.

## PART 2 - PRODUCTS

### 2.1 SYSTEM

- A. Manufacturers:
  - 1. Manufacturer Contact List:
    - a. CertainTeed Roofing Products, Valley Forge, PA [www.certainteed.com](http://www.certainteed.com).
      - 1) Contact Information: Wendy Fox, (800) 404-9880 [wfox@dataworksintl.com](mailto:wfox@dataworksintl.com).
    - b. GAF Materials Corp., Wayne, NJ [www.gaf.com](http://www.gaf.com).
      - 1) Contact Information: John Arellano (office) (210) 896-1041 (fax) (210) 259-8050.
    - c. Malarkey Roofing Products, Portland OR:
      - 1) Contact Information: Joe Russo (425) 418-3456 [Joe.Malarkey@outlook.com](mailto:Joe.Malarkey@outlook.com).
    - d. Owens Corning, Toledo, OH [www.owenscorning.com](http://www.owenscorning.com).
      - 1) Duration Premium shingles are available in all areas of the USA and Canada including all Duration Premium colors under Church contract. Request shingles through local distribution. Any distribution questions, contact Area Sales Manager.

- 2) For all other questions, Contact: Sam Baroudi (419) 248-7754  
[sam.baroudi@owenscorning.com](mailto:sam.baroudi@owenscorning.com). or Robert Hill (801) 553-2417  
[Robert.Hill@owenscorning.com](mailto:Robert.Hill@owenscorning.com).

B. Components:

1. Shingles And Underlayment:

- a. Fiberglass mat shingles meeting or exceeding requirements of:
- 1) UL Class A Fire Resistance.
  - 2) ASTM D3018/D3018M, Type I (self sealing).
  - 3) Standard Wind Areas: ASTM D3161/D3161M UL Class D.
  - 4) ASTM E108 Class A.
  - 5) ASTM D3462/D3462M where required by local codes.
  - 6) Impact Resistant Shingles: Meet requirements of UL 2218 Class 4 Impact, ASTM E108 Class A Fire Resistance, ASTM D3161/D3161M Class F Wind, ASTM D7158/D7158M Class H Wind, ASTM D3018/D3018M Type 1, ASTM D3462/D3462M, and UL 790 Class A Fire Resistance.
  - 7) Secondary Underlayment: Meet requirements of ASTM D1970/D1970M and UL 790 Class A Fire Resistance.
  - 8) Primary (Synthetic) Underlayment: Meet requirements of ASTM D226/D226M and ASTM D4869/D4869M (physical properties only) or ASTM D1970/D1970M and ASTM E108 Class A Fire.
  - 9) Color to match existing as approved by Architect from Shingle Manufacturer's full color line.
- b. Category Three Approved Manufactures and Products. See Section 01 6200 for definitions of Categories:
- 1) CertainTeed:
    - a) Shingles:
      - (1) Standard Wind: Hatteras / Landmark Premium.
      - (2) Impact Resistant: Landmark IR.
    - b) Primary Underlayment Under Shingles:
      - (1) Synthetic Underlayment: Diamond Deck.
    - c) Secondary Underlayment Under Shingles:
      - (1) WinterGuard Granular.  
or
      - (2) WinterGuard Sand.  
or
      - (3) WinterGuard High Tack/High Temperature.
  - 2) GAF:
    - a) Shingles:
      - (1) Standard Wind: Timberline Ultra HD.
      - (1) Impact Resistant: Timberline ArmorShield II.
    - b) Primary Underlayment Under Shingles:
      - (1) Synthetic Underlayment: Tiger Paw.
    - c) Secondary Underlayment Under Shingles:
      - (1) Weatherwatch.  
or
      - (2) StormGuard.
    - d) Secondary Underlayment Under Shingles over Unheated Buildings:
      - (1) Not required over unheated buildings such as Storage Shed and Stake Pavilions.
  - 3) Owens Corning:
    - a) Note:
      - (1) Duration Premium shingles are available in all areas of the USA and Canada including all Duration Premium colors under Church contract. Request shingles through local distribution.
      - (2) Any questions, contact Manufactures Area Sales Manager.
    - b) Shingles:
      - (1) Standard Wind: Duration Premium shingles.
      - (2) Impact Resistant: Duration Storm Impact-Resistant Shingles with WeatherGuard.

- c) Primary Underlayment Under Shingles:
  - (1) Synthetic Underlayment: Deck Defense High Performance Roof Underlayment.
- d) Secondary Underlayment Under Shingles:
  - (1) Weatherlock G Granulated Self-Sealing Ice & Water Barrier.  
or
  - (2) Weatherlock Specialty Tile & Metal for High Temperature.  
or
  - (3) Weatherlock Cold Climate for cold weather adhesion and flexibility.

## 2.2 ACCESSORIES

### A. Elastomeric Roofing Sealant:

- 1. Design Criteria:
  - a. Meet requirements of ASTM D3019/D3019M.
  - b. Non-asphalt roofing cement (not permitted).
  - c. Elastomeric.
  - d. Cold temperature pliability.
  - e. Compatible with roof penetration boots.
- 2. Category Four Products And Manufacturers. See Section 01 6200 for definitions of Categories:
  - a. Flintbond SBS Modified Bitumen Caulk by CertainTeed.

### B. Fasteners:

- 1. Primary Underlayment:
  - a. Corrosion resistant roofing nails with **one inch (25 mm)** diameter head and **3/4 inch (19 mm)** long shank minimum.
    - 1) If shingles applied as underlayment is laid, use metal or plastic head Simplex roofing nails.
    - 2) If shingles not applied as underlayment is laid, use plastic head only.
  - b. Staples not permitted.
- 2. Shingles:
  - a. Design Criteria:
    - 1) Meet following requirements for nails:
      - a) Comply with ASTM F1667, Type I, Style 20-Roofing Nails.
      - b) Eleven gauge galvanized steel or equivalent corrosion-resistant roofing nail.
      - c) Nail head sizes: **3/8 inch (9.5 mm)** nominal diameter.
      - d) Sufficient length to penetrate through roof sheathing **1/4 inch (6 mm)** or **3/4 inch (19 mm)** minimum into solid wood decking.
      - e) Hot-dipped galvanized or electroplated fasteners comply with requirements of ASTM A153, Class D.
      - f) Stainless-steel fasteners meet requirements of Type 304 (UNS S30400) or Type 316 (UNS S31600).
  - b. General:
    - 1) Hot-dipped galvanized, electroplated non-corrosive gun-driver nails, or stainless-steel fasteners may be used.
    - 2) Fasteners within **15 miles (24.1 km)** of coastal areas (oceanside) applications must use hot-dipped galvanized or stainless steel.
    - 3) All exposed fasteners (including ridge shingles) must use hot-dipped galvanized or stainless steel.
    - 4) Staples not permitted:

## PART 3 - EXECUTION

### 3.1 INSTALLERS

- A. Category Three Approved Manufacture's Roofing Installers: See Section 01 4301.

1. Utah Area:
  - a. Approved Installers:
    - 1) CertainTeed:
      - a) AMCO American Roofing Co., Salt Lake City, UT – Contact: Keith J Yorgason (801) 269-1276.
      - b) Far West Roofing, Bluffdale, UT – Contact Douglas Cooper (801) 253-7799.
      - c) Heritage Roofing, Bluffdale, UT – Contact: James Smith (801) 576-8447.
      - d) Island Heights Construction Inc., Logan, UT – Contact: Casey Ringer (435) 753-7403.
      - e) JTS Roofing Inc., Ogden, UT – Contact: Todd Shupe (801) 627-6450.
      - f) Mountain Peak Builders, Inc., Logan, UT – Contact: Zane Rust (435) 787-4174.
      - g) North Face Roofing, Inc., Park City, UT – Craig Peters (801) 455-8492.
      - h) Perkes Roofing, Ogden, UT – Contact: Mark Perkes (801) 731-6918.
      - i) Redd Roofing Co., Ogden, UT – Lance Redd (801) 621-1363.
      - j) Stout Roofing Inc., St George, UT - Contact: Kelly Casey (435) 635-4288.
      - k) Stuart Roofing, Ogden, UT, Forest Stuart (801) 394 1923.
      - l) VIP Roofing, Centerville, UT – Contact: Max Ker (801) 631-6182.
      - m) White Roofing Co., Nephi, UT – Contact: Charles Shannon White (801) 376-1088.
    - 2) GAF:
      - a) American Roofing Co. (AMCO), Salt Lake City, UT – Contact: Keith Yorgason (801) 269-1276.
      - b) Aspen Roofing, Salt Lake City, UT – Contact: Jon Brady (801) 483-1660.
      - c) Capital Roofing Service, Inc., Sandy, UT – Contact: Paul Hitzman (801) 562-5568.
      - d) Fortress Roofing, Murray, UT – Contact: Adam Cordon (801) 509-8625.
      - e) Knockout Roofing, Riverton, UT – Contact Jared Gran (801) 604-4090.
      - f) Lifetime Roofing, West Point, UT - Parker Cornably (801) 200-7426.
      - g) Parrish Construction, American Fork, UT – Contact: Tyler Parrish (801) 787-3633.
      - h) RSW Plus, Nephi, UT – Contact: Rick White (435) 623-1719.
      - i) Skyline Roofing Inc., La Verkin, UT - Contact: Adam Stout (435) 635-3172.
      - j) Wesley Green Roofing, UT – Contact: Scott Horsepool (801) 486-3411.
    - 3) Owens-Corning:
      - a) American Roofing Co. (AMCO), Salt Lake City, UT – Contact: Keith J Yorgason (801) 269-1276.

### 3.2 EXAMINATION

- A. Verification Of Conditions:
  1. Examine deck to determine if it is satisfactory for installation. Conditions include, but are not limited to, moisture on deck, protruding deck fasteners, specified gaps between sheathing, and other items.
    - a. Report unsatisfactory conditions in writing to Architect.
    - b. Commencement of Work by installer is considered acceptance of substrate.

### 3.3 PREPARATION

- A. Protection Of In-Place Conditions:
  1. Install only as much roofing as can be made weathertight each day, including flashing and detail work.
- B. Surface Preparation:
  1. Clean roof deck:
    - a. Remove dirt, protruding nails, shingle nails, and debris, before installation of underlayment.
  2. Roof deck must be dry to help prevent buckling of deck, which can result in deck movement and damage to primary underlayment.
  3. Following Manufacturer's recommendations for placing materials on roof.
    - a. Prevent material from sliding off roof.

### 3.4 INSTALLATION

- A. General:
1. Schedule and execute work without exposing interior building areas to effects of inclement weather. Protect existing building and its contents against all risks.
- B. Sequence of Roofing Materials as shown and noted on Contract Drawings:
1. General Secondary Underlayment.
  2. Valley Secondary Underlayment (36 inch (915 mm) wide Primary Underlayment under Valley Metal).
  3. 12 inch strip of Secondary Underlayment over nailed edges (of Valley Metal).
  4. General Primary Underlayment.
  5. Asphalt Shingles, Step Flashings.
  6. Counter Flashing.
- C. Underlayment:
1. General:
    - a. Temporary Roof:
      - 1) Do not use permanent underlayment installation as temporary roof.
      - 2) If temporary roof is used, remove completely before installation of permanent underlayment.
    - b. Follow Shingle Manufacturer's recommendations for installation of primary and secondary underlayment, particularly at eaves, rakes, and penetrations, unless specified installation procedures and Contract Drawing details are more stringent.
    - c. Avoid scuffing underlayment that can compromise surface and cause leaking. If scuffing occurs, following Manufacturer's recommendation for repair.
    - d. Staples are not permitted.
    - e. Weather conditions:
      - 1) Do not leave underlayment exposed to weather more than thirty (30) days after beginning of underlayment installation even if Manufacture allows longer period of time.
      - 2) If underlayment is exposed for more than thirty (30) days after beginning of underlayment installation, treat as temporary roof under first paragraph above.
      - 3) If moisture is deposited on exposed underlayment, obtain written approval from Shingle Manufacturer's Representative before installing shingles.
    - f. Install valley secondary underlayment, valley primary underlayment, and valley metal after installation of general secondary underlayment, but before installation of general primary underlayment.
  2. Primary Underlayment:
    - a. Apply 48 inch (1 200 mm) wide courses over complete deck, including areas covered with secondary underlayment unless specified otherwise.
      - 1) Overlap underlayment before fastening.
      - 2) Maintain end laps of 6 inch (150 mm) and side laps of 3 inch (76 mm).
      - 3) Stop primary underlayment between 3 and 6 inches (75 and 150 mm) of inside edge of strip of secondary underlayment installed over edge of formed valley metal.
    - b. Nailing Synthetic Underlayment:
      - 1) Use low-profile plastic or steel cap corrosion resistant nails with 1 inch (25 mm) diameter heads to fasten underlayment in place. (Fastening underlayment without caps is not permitted).
      - 2) Nails must be driven properly. Improperly driven fasteners such as over-driving, under-driving and nails driven at an angle are not permitted.
      - 3) Fasteners should be long enough to penetrate at least 3/4 inch (19 mm) into roof sheathing. Fasteners must be lie flush to roof deck at 90 degree angle to roof deck and tight with underlayment.
      - 4) Do not nail through metal flashing, except drip edge, when installing primary underlayment.
      - 5) Follow Shingle Manufacturer's installation instructions for following:
        - a) Securing underlayment to roof deck adjusting for roof slope nailing requirements.
        - b) Side lap, end lap, and overlapping nailing requirements.
        - c) Rake and eave nailing requirements.
        - d) High wind condition nailing requirements.

- e) Sealants recommendations.
  - 3. Secondary Underlayment:
    - a. Under Shingles:
      - 1) Lap end joints **6 inches (150 mm)** and side joints **3 inch (76 mm)** minimum.
      - 2) Apply continuous **12 inches (300 mm)** wide strip at edge of eaves and rakes before installing drip edge.
      - 3) Apply two (2) **36 inch (900 mm)** wide courses along eaves and rakes as described in Contract Documents with first course overlapping drip edge and **12 inches (300 mm)** wide previously applied strip.
  - 4. Valley Underlayment:
    - a. Apply three (3) continuous **36 inch (900 mm)** wide sheets of secondary underlayment in valley lapped to provide **102 inch (2 590 mm)** wide covered area centered over valley.
    - b. Apply one (1) continuous **36 inch (300 mm)** wide strip of primary underlayment atop secondary underlayment and centered over valley.
    - c. Install formed valley metal over strip of primary underlayment.
      - 1) Nail top of each section and lap **8 inches (200 mm)** in direction of flow.
      - 2) Seal laps with continuous bead of elastomeric roofing sealant.
      - 3) Secure edges of valley metal with fasteners spaced at **12 inches (300 mm)** maximum on center and approximately **1/2 inch (13 mm)** in from edge of metal.
    - d. Install **12 inches (300 mm)** wide strips of secondary underlayment lapping nailed edge of formed valley metal **3 inches (75 mm)**.
- D. Shingles:
1. Before installing shingles, inspect underlayment and metal installation with Architect and Owner. Correct improperly installed and damaged material before beginning shingle installation.
  2. Racking installation method is not permitted by Owner and will be considered non-conforming work.
  3. Starter shingles:
    - a. Manufacturer's starter shingles are required for Shingle Warranty.
    - b. Install shingles at eave and rakes in accordance with Shingle Manufacturer's instructions.
    - c. Cut shingles in accordance with Shingle Manufacturer's instructions, or use approved starter course.
    - d. Nail to eave granule side up in continuous mastic bed with cut edge down-slope and edge overhanging eave **3/8 inch (9 mm)** so sealing tabs are at edge of eave.
    - e. Install shingles with maximum exposure recommended by Shingle Manufacturer.
    - f. Lay first course directly over starter strip with ends flush with starter strip at eaves and so joints in starter strip are offset **4 inches (100 mm)** minimum from joints in first course.
  4. Lay shingles so end joints are offset in accordance with Shingle Manufacturer's installation procedures.
  5. Insure alignment by snapping chalk line at least each fifth course to control horizontal and vertical alignment.
  6. Run courses true to line with end joints properly placed. Leave shingles flat without wave and properly placed.
  7. Hip and ridge shingles:
    - a. Manufacturer's hip and ridge shingles are required for Shingle Warranty.
    - b. Install specified hip and ridge shingles in accordance with Shingle Manufacturer's instructions.
    - c. Run ridge shingles as directed by Architect.
  8. Nailing:
    - a. General:
      - 1) Six (6) Nail Pattern as recommended by Shingle Manufacturer for Shingle Warranty in each shingle.
      - 2) Place in relation to top edge of shingle as required by Shingle Manufacturer.
      - 3) Place nails **one inch (25 mm)** from each end of shingle and remainder evenly spaced between.
      - 4) Should any nail fail to penetrate sheathing by **1/4 inch (6 mm)** minimum, drive additional nail nearby.
    - b. Nailing guns:
      - 1) Nails must be driven properly. Improperly driven fasteners such as over-driving, under-driving and nails driven at an angle are not permitted.

- 2) Adjust nail gun pressure for nailing flush and tight to deck without cutting shingle surface.
  - 3) Drive nails perpendicular to shingle surface so nail head is flat against shingle.
  - 4) Should any nail fail to penetrate sheathing by **1/4 inch (6 mm)** minimum, drive additional nail nearby.
9. Hand-Sealing:
- a. If ambient temperature or exposure to sun will not be sufficient to secure adhesive strip to under-lying shingle within one week, hand seal shingles with elastomeric roofing sealant.
10. Over valley metal:
- a. Do not drive nails through valley metal.
  - b. Run chalk line so valley metal will be exposed **6 inches (150 mm)** wide at top and diverge **3/32 inch (one mm)** per **ft (300 mm)** down to eaves.
  - c. Neatly trim shingles to this line.
  - d. Seal trimmed shingle edges to valley metal with continuous bead of elastomeric roofing sealant applied within **one inch (25 mm)** of shingle edge.
11. Vent pipe sleeve flange:
- a. Vent pipe sleeve flange as specified in Section 07 6310.
  - b. Fit shingles under lower edge and over sides and upper edge.
  - c. Set vent pipe flange in elastomeric roofing sealant.
  - d. Embed shingles in elastomeric roofing sealant where they overlap flange.
  - e. Apply bead of elastomeric roofing sealant at junction of vent pipe and vent flashing.

### 3.5 FIELD QUALITY CONTROL

- A. Non-Conforming Work:
1. Correct any work found defective or not complying with Contract Document requirements at no additional cost to the Owner.
  2. Raking installation method is not permitted by Owner and will be considered to be not complying with Contract Document requirements and must be corrected at no additional cost to Owner.

### 3.6 CLEANING

- A. General:
1. All tools and unused materials must be collected at end of each workday and stored properly off finished roof surface and protected from exposure to elements.
  2. Leave metals clean and free of defects, stains, and damaged finish.
    - a. Replace fascia metal that is scratched through finish to base metal.
  3. Properly clean finished roof surface after completion.
  4. Verify drains and gutters are not clogged.
  5. Clean shingles and building of soiling caused by this installation.
  6. Clean and restore all damaged surfaces to their original condition.
- B. Waste Management:
1. Disposal:
    - a. All work areas are to be kept clean, clear and free of debris always.
    - b. Do not allow trash, waste, or debris to collect on roof. These items shall be removed from roof daily.
    - c. Remove debris resulting from work of this Section from roof and site. Dispose of or recycle all trash and excess material in manner conforming to current EPA regulations and local laws.

### 3.7 PROTECTION

- A. Do not permit traffic over finished roof surface.

**END OF SECTION**

**SECTION 07 8400****FIRESTOPPING****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install firestopping not involving penetrations as described in Contract Documents.
  - 2. Quality of firestopping materials and systems used for penetrations on Project, including submittal requirements.
- B. Related Requirements:
  - 1. Furnishing and installing of penetration firestopping specified under Section installing work penetrating structure.

**1.2 REFERENCES**

- A. Reference Standards:
  - 1. American Society For Testing And Materials:
    - a. ASTM E84-18b, 'Standard Test Method for Surface Burning Characteristics of Building Materials'.
    - b. ASTM E119-18c, 'Standard Test Methods for Fire Tests of Building Construction and Materials'.
    - c. ASTM E814-13a(2017), 'Standard Test Method for Fire Tests of Penetration Firestop Systems'.
    - d. ASTM E1996-17, 'Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes'.
  - 2. International Building Code (IBC) (2018 or latest approved edition):
    - a. Chapter 7, 'Fire And Smoke Protection Features':
      - 1) Section 703, "Fire-Resistance Ratings And Fire Tests":
  - 3. Underwriters Laboratories:
    - a. UL 'Fire Resistance Directory', current edition, contains listing of approved Penetration Firestop Systems:
      - 1) Through-penetration firestop devices.
      - 2) Fire resistance ratings.
      - 3) Through-penetrations firestop systems.
      - 4) Fill, void, or cavity material.
    - b. UL 263, 'Fire Tests of Building Construction and Materials' (14th Edition).
    - c. UL 723: 'Standard for Safety Test for Surface Burning Characteristics of Building Materials'; (11th edition - 2018).
    - d. UL 1479, 'Standard for Safety for Fire Tests of Through-Penetration Firestops' (4th Edition).
    - e. UL 2079, 'Tests for Fire Resistance of Building Joint Systems' (5th Edition).

**1.3 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate construction of openings and penetrating items to ensure that firestopping assemblies are installed in compliance with specific requirements.
  - 2. Coordinate sizes of sleeves, openings, core drilled holes, or cut openings to accommodate through-penetration firestop systems.
- B. Sequencing:



1. Perform work of this section in proper sequence to prevent damage to firestop system and to ensure installation will occur prior to enclosing or concealing work. Firestopping shall precede finishing of gypsum board.
  - a. Do not conceal firestopping installations until inspection agency or authorities having jurisdiction, as required, have examined each installation.

#### 1.4 SUBMITTALS

- A. Action Submittals:
  1. Shop Drawings:
    - a. Show each type of Penetration Firestop System to be used on Project with design approval reference number.
    - b. Identify locations where each type of Penetration Firestop System is to be installed.
- B. Informational Submittals:
  1. Qualification Statement:
    - a. Manufacturer/Installer:
      - 1) Provide Qualification documentation if requested by Architect or Owner.

#### 1.5 QUALITY ASSURANCE

- A. Regulatory Agency Sustainability Approvals:
  1. Conform to applicable building codes for fire resistance ratings.
  2. Comply with installation requirements and protocol outlined in Firestop Contractors International Association 'FICIA 'Manual of Practice' handbook.
  3. Each Penetration Firestop System shall be UL/ULC listed for that type of penetration occurring on Project.
  4. Ratings shall be in accordance with ASTM E814, UL 1479, or IBC Section 703, 'Fire-Resistance Ratings And Fire Tests' as acceptable to local code authority.
    - a. Provide Firestop Systems with F Ratings not less than Fire-Resistance Rating of Constructions penetrated.
    - b. Provide Firestop Systems with T and F Ratings, as determined per ASTM E814.
    - c. Provide Joint Sealants with Fire-Resistance Ratings as determined per ASTM E119.
    - d. Provide Products with Flame-Spread values of less than 25 and smoke developed values of less than 450, as determined per ASTM E84.
    - e. Surface burning characteristics (per ASTM E84): 25 or less. Tested in accordance with UL 1479 or ASTM E814.
- B. Qualifications:
  1. Manufacturer Qualifications:
    - a. Company that specializes in manufacturing the type of products specified, with minimum of five (5) years of documented experience.
  2. Upon request, submit documentation.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery And Acceptance Requirements:
  1. Deliver firestopping materials to Project Site in original, new unopened containers or packages bearing manufacturer's printed labels.
- B. Storage And Handling Requirements:
  1. Store and handle firestopping materials in compliance with manufacturers written instructions.
  2. Protect materials from freezing or overheating and to prevent deterioration or damage due to moisture, temperature changes, contaminants or other causes.
  3. Store materials off floor at temperatures between 40 deg F (4.4 deg C) and 90 deg F (32.2 deg C) or as re

## 1.7 FIELD CONDITIONS

- A. Ambient Conditions:
1. Temperature: Do not install firestopping materials when ambient or substrate temperatures are outside limits permitted by manufacturer of firestopping materials.
  2. Humidity and Moisture: Do not install the Work of this Section under conditions that are detrimental to the application, curing, and performance of the materials.
  3. Ventilation: Provide sufficient ventilation wherever firestopping materials are installed in enclosed spaces. Follow manufacturer's recommendations.

## 1.8 WARRANTY

- A. Manufacturer Warranty:
1. Firestop materials shall be free from cracking, checking, dusting, flaking, spalling, separation, and blistering for period of 10 years from Date of Substantial Completion. Reinstall or repair such defect or failures at no cost to Owner.

## PART 2 - PRODUCTS

### 2.1 SYSTEMS

- A. Manufacturers:
1. Type Two Acceptable Manufacturers:
    - a. Members of International Firestop Council [www.firestop.org](http://www.firestop.org) and member in good standing.
    - b. Equal as approved by Architect before installation. See Section 01 6200.
- B. Materials:
1. General:
    - a. Sealant, packing material, or collar system required by Firestop Manufacturer for Firestop Penetration System to comply with listed design.
    - b. Primers, sleeves, forms, insulation, packing, stuffing, and accessories: Type required for tested assembly design.
  2. Firestopping Assembly Requirements:
    - a. 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.
    - b. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use any system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
    - c. Through Penetration Firestopping: Use any system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
  3. Firestopping System:
    - a. Any material meeting requirements.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification Of Conditions:
1. Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion.
3. Verify ducts, piping, equipment, and other similar items that would interfere with application of firestopping shall be in place.
4. Do not commence Work until unsatisfactory conditions have been corrected.
  - a. Commencement of installation constitutes acceptance of conditions and responsibility for satisfactory performance.

### 3.2 PREPARATION

#### A. Protection Of In-Place Conditions:

1. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
2. Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work. Remove tape as soon as it is possible to do so without disturbing firestopping seal with substrates.

#### B. Surface Preparation:

1. Clean out openings, control, and expansion joints immediately before installation of through-penetration firestopping. Comply with recommendations of firestopping manufacturer and the following requirements:
  - a. Remove foreign materials from surfaces of openings and joint substrates, and from penetrating items that could interfere with adhesion of firestopping.
  - b. Clean opening and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
  - c. Remove laitance and form release agents from concrete.
  - d. Do not apply firestopping materials to surfaces which have been previously painted or treated with sealer, curing compound, water repellent, or other similar coating, unless application has been accepted by manufacturer of firestopping products.
  - e. Install damming materials, as recommended by sealant manufacturer, to hold sealant in place.
2. Priming:
  - a. Prime substrates where recommended by firestopping manufacturer using manufacturer's recommended products and methods.
  - b. Confine primers to areas of bond. Do not allow spillage and migration onto exposed surfaces.
  - c. Apply prime coat in compliance with manufacturer's instructions.

### 3.3 INSTALLATION

#### A. General:

1. Install firestopping in accordance with Manufacturer's instructions for installation of firestopping products.
2. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
3. Do not cover installed firestopping until inspected by authority having jurisdiction.

### 3.4 PROTECTION

- #### A.
- Protect surfaces adjacent to through-penetration firestops with suitable covering to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or that would be caused by cleaning methods used to remove smears from firestopping materials.

- B. Protect firestopping during and after curing period from contact with contaminating substances, or damage resulting from adjacent Work.

### **3.5 CLEANING**

- A. Clean off excess fill materials and sealants adjacent to penetrations by methods and cleaning materials recommended by manufacturers of firestopping products and of products in which penetrations occur.

**END OF SECTION**



**SECTION 07 9213****ELASTOMERIC JOINT SEALANTS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install sealants not specified to be furnished and installed under other Sections.
  - 2. Quality of sealants to be used on Project not specified elsewhere, including submittal, material, and installation requirements.
- B. Related Requirements:
  - 1. Removing existing sealants specified in Sections where work required.
  - 2. Furnishing and installing of sealants is specified in Sections specifying work to receive new sealants.

**1.2 REFERENCES**

- A. Definitions:
  - 1. Sealant Types and Classifications:
    - a. ASTM Specifications:
      - 1) Type:
        - a) Type S: Single-component sealant.
        - b) Type M: Multi-component sealant.
      - 2) Grade:
        - a) Grade P: Pourable or self-leveling sealant used for horizontal traffic joints.
        - b) Grade NS: Non-sag or gunnable sealant used for vertical and non-traffic joints.
      - 3) Classes: Represent movement capability in percent of joint width.
        - a) Class 100/50: Sealant that, when tested for adhesion or cohesion under cyclic movement shall withstand of at least 100 percent increase and decrease of at least 50 percent of joint width as measured at time of application.
        - b) Class 50: Sealant that, when tested for adhesion or cohesion under cyclic movement shall withstand increase and decrease of at least 50 percent of joint width as measured at time of application.
        - c) Class 25: Sealant that, when tested for adhesion or cohesion under cyclic movement shall withstand increase and decrease of at least 25 percent of joint width as measured at time of application.
        - d) Class 12: Sealant that, when tested for adhesion and cohesion under cyclic movement shall withstand increase and decrease of at least 12 percent of joint width as measured at time of application.
      - 4) Use:
        - a) T (Traffic): Sealant designed for use in joints in pedestrian and vehicular traffic areas such as walkways, plazas, decks and parking garages.
        - b) NT (Non-Traffic): Sealant designed for use in joints in non-traffic areas.
        - c) I (Immersion): Sealant that meets bond requirements when tested by immersion (Immersion rated sealant applications require primer).
        - d) M (Mortar): Sealant that meets bond requirements when tested on mortar specimens.
        - e) G (Glass): Sealant that meets bond requirements when tested on glass specimens.
        - f) A (Aluminum): Sealant that meets bond requirements when tested on aluminum specimens.

- g) O (Other): Sealant that meets bond requirements when tested on substrates other than standard substrates, being glass, aluminum, mortar.
- 2. Silicone: Any member of family of polymeric products whose molecular backbone is made up of alternating silicon and oxygen atoms and which has pendant hydrocarbon groups attached to silicon atoms. Used primarily as a sealant. Offers excellent resistance to water and large variations in temperature (minus 100 deg F to + 600 deg F) (minus 73.3 deg C to + 316 deg C).

B. Reference Standards:

- 1. ASTM International:
  - a. ASTM C920-14a, 'Standard Specification for Elastomeric Joint Sealants'.
  - b. ASTM C1193-16, 'Standard Guide for Use of Joint Sealants'.
  - c. ASTM C1330-18, 'Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants'.
  - d. ASTM C1481-12(2017) 'Standard Guide for Use of Joint Sealants with Exterior Insulation & Finish Systems (EIFS)'.
  - e. ASTM D5893/D5893M-16, 'Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements'.

### 1.3 ADMINISTRATIVE REQUIREMENTS

A. Scheduling:

- 1. Schedule work so waterproofing, water repellents and preservative finishes are installed after sealants, unless sealant manufacturer approves otherwise in writing.
- 2. Ensure sealants are cured before covering with other materials.

### 1.4 SUBMITTALS

A. Action Submittals:

- 1. Product Data:
  - a. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
  - b. Manufacturer's literature for each Product.
  - c. Schedule showing joints requiring sealants. Show also backing and primer to be used.

B. Informational Submittals:

- 1. Certificates:
  - a. Manufacturer's Certificate:
    - 1) Certify products are suitable for intended use and products meet or exceed specified requirements.
    - 2) Certificate from Manufacturer indicating date of manufacture.
- 2. Manufacturers' Instructions:
  - a. Manufacturer's installation recommendations for each Product.
  - b. Manufacturer's installation for completing sealant intersections when different materials are joined.
  - c. Manufacturer's installation for removing existing sealants and preparing joints for new sealant.

### 1.5 QUALITY ASSURANCE

A. Qualifications:

- 1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten (10) years documented experience.
- 2. Applicator Qualifications:
  - a. Company specializing in performing work of this section.

- b. Provide if requested, reference of projects with minimum three (3) years documented experience, minimum three (3) successfully completed projects of similar scope and complexity, and approved by manufacturer.
  - c. Designate one (1) individual as project foreman who shall be on site at all times during installation.
- B. Preconstruction Testing:
1. Pre-construction testing is not required when sealant manufacturer can furnish data acceptable to Architect based on previous testing for materials matching those of the Work.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Acceptance Requirements:
1. Deliver and keep in original containers until ready for use.
  2. Inspect for damage or deteriorated materials.
- B. Storage and Handling Requirements:
1. Handle, store, and apply materials in compliance with applicable regulations and material safety data sheets (MSDS).
  2. Handle to prevent inclusion of foreign matter, damage by water, or breakage.
  3. Store in a cool dry location, but never under 40 deg F (4 deg C) or subjected to sustained temperatures exceeding 90 deg F (32 deg C) or as per Manufacturer's written recommendations.
  4. Do not use sealants that have exceeded shelf life of product.

## 1.7 FIELD CONDITIONS

- A. Ambient Conditions:
1. Do not install sealant during inclement weather or when such conditions are expected. Allow wet surfaces to dry.
  2. Follow Manufacturer's temperature recommendations for installing sealants.

## 1.8 WARRANTY

- A. Manufacturer Warranty:
1. Signed warranties against adhesive and cohesive failure of sealant and against infiltration of water and air through sealed joint for period of three (3) years from date of Substantial Completion.
    - a. Manufacturer's standard warranty covering sealant materials.
    - b. Applicator's standard warranty covering workmanship.

## PART 2 - PRODUCTS

### 2.1 SYSTEMS

- A. Manufacturers:
1. Manufacturer Contact List:
    - a. Dow Corning Corp., Midland, MI [www.dowcorning.com](http://www.dowcorning.com).
    - b. Franklin International, Inc. Columbus, OH [www.titebond.com](http://www.titebond.com).
    - c. GE Sealants & Adhesives (see Momentive Performance Materials Inc.).
    - d. Laticrete International Inc., Bethany, CT [www.laticrete.com](http://www.laticrete.com).
    - e. Momentive Performance Materials Inc. (formally GE Sealants & Adhesives), Huntersville, NC [www.ge.com/silicones](http://www.ge.com/silicones).
    - f. Sherwin-Williams, Cleveland, OH [www.sherwin-williams.com](http://www.sherwin-williams.com).



- g. Sika Corporation, Lyndhurst, NJ [www.sikaconstruction.com](http://www.sikaconstruction.com) or Sika Canada Inc, Pointe Claire, QC [www.sika.ca](http://www.sika.ca).
- h. Tremco, Beachwood, OH [www.tremcosealants.com](http://www.tremcosealants.com) or Tremco Ltd, Toronto, ON (800) 363-3213.

B. Materials:

1. Design Criteria:

- a. Compliance: Meet or exceed requirements of these standards:
  - 1) ASTM C920: Elastomeric joint sealant performance standard.
  - 2) ASTM D5893/D5893M: Silicone Joint Sealant for Concrete Pavements.
- b. Comply with Manufacturer's ambient condition requirements.
- c. Sealants must meet Manufacturer's shelf-life requirements.
- d. Sealants must adhere to and be compatible with specified substrates.
- e. Sealants shall be stable when exposed to UV, joint movements, and environment prevailing at project location.
- f. Primers (Concrete, stone, masonry, and other nonporous surfaces typically do not require a primer. Aluminum and other nonporous surfaces except glass require use of a primer. Installer Option to use Adhesion Test to determine if primer is required or use primer called out in related sections):
  - 1) Adhesion Test:
    - a) Apply silicone sealant to small area and perform adhesion test to determine if primer is required to achieve adequate adhesion. If necessary, apply primer at rate and in accordance with Manufacturer's instructions. See 'Field Quality Control' in Part 3 of this specification for Adhesive Test.
  - 2) If Primer required, shall not stain and shall be compatible with substrates.
  - 3) Allow primer to dry before applying sealant.

2. Sealants At Exterior Building Elements:

a. Description:

- 1) Weathersealing expansion, contraction, perimeter, and other movement joints which may include all or part of the following for project:
  - a) Aluminum entrance perimeters and thresholds.
  - b) Columns.
  - c) Connections.
  - d) Curtainwalls.
  - e) Door frames.
  - f) EIFS to metal joints.
  - g) Joints and cracks around windows.
  - h) Louvers.
  - i) Masonry.
  - j) Parapet caps.
  - k) Wall penetrations.
  - l) Other joints necessary to seal off building from outside air and moisture.

b. Design Criteria:

- 1) Meet following standards for Sealant:
  - a) ASTM C920: Type S, Grade NS, Class 50 Use NT, M, G, A.
- 2) Limitations:
  - a) Do not use below-grade applications.
  - b) Do not use on surfaces that are continuously immersed or in contact with water.
  - c) Do not use on wet, damp, frozen or contaminated surfaces.
  - d) Do not use on building materials that bleed oils, plasticizers or solvents, green or partially vulcanized rubber gaskets or tapes.
- 3) Color:
  - a) Architect to select from Manufacturer's standard colors.
  - b) Match building elements instead of window (do not use white that shows dirt easily).

c. Category Four Approved Products. See Section 01 6200 for definitions of Categories:

- 1) Dow Corning:
  - a) Primer: 1200 Prime Coat.
  - b) Sealant: 791 Silicone Weatherproofing Sealant.
- 2) Momentive Performance Materials (formerly, GE Sealants & Adhesives):

- a) Primer: SS4044 Primer.
- b) Sealant: GE SCS2000 SilPruf Silicone Sealant & Adhesive.
- 3) Tremco:
  - a) Primer:
    - (1) Metal surface: No. 20 primer.
    - (2) Porous surfaces: No. 23 primer.
  - b) Sealant: Spectrum 1 Silicone Sealant.
- 3. Sealants At Exterior Sheet Metal And Miscellaneous:
  - a. Description:
    - 1) Weathersealing expansion, contraction, perimeter, and other movement joints which may include all or part of the following for project:
      - a) Flashings.
      - b) Gutters.
      - c) Penetrations in soffits and fascias.
      - d) Roof vents and flues.
      - e) Lightning protection components.
  - b. Design Criteria:
    - 1) Meet following standards for Sealant:
      - a) ASTM C920: Type S Grade NS, Class 25 (min) Use NT, M, G, A and O.
    - 2) Limitations:
      - a) Do not use below-grade applications.
      - b) Do not use on surfaces that are continuously immersed or in contact with water.
      - c) Do not use on wet, damp, frozen or contaminated surfaces.
      - d) Do not use on building materials that bleed oils, plasticizers or solvents, green or partially vulcanized rubber gaskets or tapes.
  - c. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - 1) Dow Corning: 790 Silicone Building Sealant.
    - 2) Momentive Performance Materials (formerly, GE Sealants & Adhesives): GE SCS2350 Silicone Elastomeric Sealant.
    - 3) Tremco: Tremsil 600 Silicone Sealant.
- 4. Sealants At Expansion Joints in Exterior Concrete (Aprons, Entryway Slabs, Mowstrips, Retaining Walls, Sidewalks):
  - a. Expansion Joints:
    - 1) Design Criteria:
      - a) Meet following standards for Sealant:
        - (1) ASTM C920: Type S, Grade NS, Class 100/50 Use T, NT, M, G, A, and O.
    - 2) Sealant required at expansion for following areas:
      - a) Between entryway slabs and building foundations.
      - b) Between sidewalks and building foundations.
      - c) Miscellaneous vertical applications.
    - 3) Sealant NOT required at expansion joints for following areas:
      - a) Within aprons and where aprons abut building foundations and sidewalks.
      - b) Within mowstrips and where mowstrips abut building foundations and sidewalks.
      - c) Within sidewalks.
    - 4) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - a) Dow Corning:
        - (1) Primer: 1200 Prime Coat.
        - (2) Sealant: 790 Silicone Building Sealant.
      - b) Sika:
        - (1) Primer: Sikasil Primer-2100.
        - (2) Sealant: Sikasil-728 NS Non-Sag Silicone Sealant.
  - b. Penetrations thru Concrete Walls:
    - 1) Design Criteria:
      - a) Meet following standards for Sealant:
        - (1) ASTM C920: Type S, Grade NS, Class 100/50 Use T, NT, M, G, A, and O.
    - 2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - a) Dow Corning:
        - (1) Primer: 1200 Prime Coat.
        - (2) Sealant: 790 Silicone Building Sealant.
      - b) Sika:

- (1) Primer: Sikasil Primer-2100.
  - (2) Sealant: Sikasil-728 NS Non-Sag Silicone Sealant.
5. Sealants At Control Joints in Exterior Concrete (Aprons, Entryway Slabs, Mowstrips, Retaining Walls, Sidewalks):
- a. Control Joints:
    - 1) Design Criteria:
      - a) Meet following standards for Sealant:
        - (1) ASTM C920, Type S, Grade P, Class 100/50; Use T, M, G, A, O.
    - 2) Sealant required at control joints in following areas:
      - a) Retaining walls.
      - b) Miscellaneous vertical applications.
    - 3) Sealant is NOT required at control joints, unless needed to protect moisture sensitive soils or by Contract Drawings, in following areas:
      - a) Within aprons.
      - b) Within mowstrips.
      - c) Within sidewalks.
      - d) Within entryway slabs.
    - 4) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - a) Dow Corning:
        - (1) Primer: 1200 Prime Coat.
        - (2) Sealant: 890-SL Silicone Building Sealant.
      - b) Sika:
        - (1) Primer: Primer: Sikasil Primer-2100.
        - (2) Sealant: Sikasil-728 SL Self-leveling Silicone Sealant.
6. Sealants At Precast Concrete Cap and Joint Covers (if Contractor Option ONE was selected in Section 03 4800):
- a. Description:
    - 1) Soft lead strip, when set and bedded in sealant, form cap which assures permanent elastic seal for any masonry joint as specified in Section 03 4800.
  - b. Design Criteria:
    - 1) Meet following standards for Sealant:
      - a) ASTM C920: Type S, Grade NS, Class 50 Use A, G, M.
      - b) Strips should be of sufficient size to cover the joint width, plus percentage allowance for anticipated joint movement, plus **1/4 inch (6.4 mm)**.
  - c. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - 1) Dow Corning:
      - a) Primer: 1200 Prime Coat.
      - b) Sealant: 791 Silicone Weatherproofing Sealant.
    - 2) Momentive Performance Materials (formerly, GE Sealants & Adhesives):
      - a) Primer: SS4044 Primer.
      - b) Sealant: GE SCS2000 SilPruf Silicone Sealant & Adhesive.
    - 3) Sika:
      - a) Primer: Sikasil Primer-2100.
      - b) Sealant: Sikasil-728 NS Non-Sag Silicone Sealant.
    - 4) Tremco:
      - a) Primer:
        - (1) Metal surface: No. 20 primer.
        - (2) Porous surfaces: No. 23 primer.
      - b) Sealant: Spectrum 1 Silicone Sealant.
7. General Interior Sealants:
- a. General:
    - 1) Inside jambs and heads of exterior door frames.
    - 2) Both sides of interior door frames.
    - 3) Inside perimeters of windows.
    - 4) Miscellaneous gaps between substrates.
  - b. Design Criteria:
    - 1) Meet ASTM C920, Type S, Grade NS, NT, and Class 25 test requirements.
    - 2) 100 percent silicone sealant.
  - c. Non-Paintable Sealant (Installer Option A):
    - 1) Category Four Approved Product. See Section 01 6200 for definitions of Categories:

- a) Dow Corning: Tub, Tile, And Ceramic Silicone Sealant.
  - b) Laticrete: Latasil Silicone Sealant.
  - c) Momentive Performance Materials (formerly, GE Sealants & Adhesives): GE SCS2800 SilGlaze II Silicone Sealant.
  - d) Sherwin Williams: White Lightning Silicone Ultra Low Odor Window and Door Sealant.
  - e) Tremco: Tremsil 200 Silicone Sealant.
  - f) Franklin International: Titebond 2601 (White) 2611 (Clear) 100% Silicone Sealant.
- d. Paintable Sealant (Installer Option B):
- 1) Category Four Approved Product. See Section 01 6200 for definitions of Categories:
    - a) Momentive Performance Materials (formerly, GE Sealants & Adhesives): GE SCS7000 Paintable Silicone Sealant.
8. Sealants For Interior Joints:
- a. Description:
    - 1) One-part acetoxycure silicone sealant with fungicides to resist mold and mildew.
  - b. Design Criteria:
    - 1) Meet ASTM C920, Type S, Grade NS, NT, and Class 25 test requirements.
    - 2) 100 percent silicone sealant.
  - c. Color: As selected by Architect from Manufacturer's standard colors.
  - d. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - 1) Dow Corning: Tub, Tile, And Ceramic Silicone Sealant.
    - 2) Laticrete: Latasil Tile and Stone Silicone Sealant.
    - 3) Momentive Performance Materials (formerly, GE Sealants & Adhesives): GE SCS1700 Sanitary Silicone Sealant.
    - 4) Tremco: Tremsil 200 Silicone Sealant.

## 2.2 ACCESSORIES

- A. Bond Breaker Tape:
  - 1. Pressure sensitive tape as by Sealant Manufacturer to suit application.
  - 2. Provide tape to prevent adhesion to joint fillers or joint surfaces at back of joint and allow sealant movement.
- B. Joint Backing:
  - 1. Comply with ASTM C1330.
  - 2. Flexible closed cell, non-gassing polyurethane or polyolefin rod or bond breaker tape as recommended by Sealant Manufacturer for joints being sealed.
  - 3. Oversized 25 to 50 percent larger than joint width.
- C. Joint Cleaner:
  - 1. Non-corrosive and non-staining type as recommended by Sealant Manufacturer, compatible with joint forming materials.
- D. Masking Tape:
  - 1. Non-staining, non-absorbent tape product compatible with joint sealants and adjacent joint surfaces.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification Of Conditions:
  - 1. Examine substrate surfaces and joint openings are ready to receive Work.
    - a. Verify each sealant is compatible for use with joint substrates.
    - b. Verify joint surfaces are clean and dry.
    - c. Ensure concrete surfaces are fully cured.

2. Sealants provided shall meet Manufacturer's shelf-life requirements.
3. Notify Architect of unsuitable conditions in writing.
  - a. Do not proceed until unsatisfactory conditions are corrected.
4. Commencement of Work by installer is considered acceptance of substrate.

### 3.2 PREPARATION

#### A. Surface Preparation:

1. Remove existing joint sealant materials where specified.
  - a. Clean joint surfaces of residual sealant and other contaminants capable of affecting sealant bond to joint surface using manufacturer's recommended joint preparation methods.
  - b. Repair deteriorated or damaged substrates as recommended by Sealant Manufacturer to provide suitable substrate. Allow patching materials to cure.
2. Surfaces shall be clean, dry, free of dust, oil, grease, dew, frost or incompatible sealers, paints or coatings that may interfere with adhesion. Prepare substrates in accordance with Manufacturer's instructions:
  - a. Porous surfaces: Clean by mechanical methods to expose sound surface free of contamination and laitance followed by blasting with oil-free compressed air.
  - b. Nonporous surfaces: Use two-cloth solvent wipe in accordance with ASTM C1193. Allow solvent to evaporate prior to sealant application.
  - c. High-pressure water cleaning: Exercise care that water does not enter through failed joints.
  - d. Primers:
    - 1) Primers enhance adhesion ability.
    - 2) Use of primers is not a substitution for poor joint preparation.
    - 3) Primers should be used always in horizontal application where there is ponding water.
3. Field test joints in inconspicuous location.
  - a. Verify joint preparation and primer required to obtain optimum adhesion of sealants to joint substrate.
  - b. When test indicates sealant adhesion failure, modify joint preparation primer, or both and retest until joint passes sealant adhesion test.
4. Masking: Apply masking tape as required to protect adjacent surfaces and to ensure straight bead line and facilitate cleaning.

#### B. Joints:

1. Prepare joints in accordance with ASTM C1193.
  - a. Clean joint surfaces of contaminants capable of affecting sealant bond to joint surface using Manufacturer's recommended instructions for joint preparation methods.
  - b. Remove dirt, dust, oils, wax, paints, and contamination capable of affecting primer and sealant bond.
  - c. Clean concrete joint surfaces to remove curing agents and form release agents.

#### C. Protection:

1. Protect elements surrounding the Work of this section from damage or disfiguration.

### 3.3 APPLICATION

#### A. General:

1. Apply silicone sealant in accordance with Manufacturer's instructions.
2. Do not use damaged or deteriorated materials.
3. Install primer and sealants in accordance with ASTM C1193 and Manufacturer's instructions.
4. Apply primer where required for sealant adhesion.
5. Install sealants immediately after joint preparation.
6. Do not use silicone sealant as per the following:
  - a. Apply caulking/sealant at temperatures below 40 deg F (4 deg C).
  - b. Below-grade applications.
  - c. Brass and copper surfaces.
  - d. Materials bleeding oils, plasticizers, and solvents.
  - e. Structural glazing and adhesive.

- f. Surfaces to be immersed in water for prolonged time.
- B. Joint Backing:
  - 1. Install joint backing to maintain sealant joint ratios recommended by Manufacturer.
  - 2. Install without gaps, twisting, stretching, or puncturing backing material. Use gage to ensure uniform depth to achieve correct profile, coverage, and performance.
  - 3. Rod for open joints shall be at least 1-1/2 times width of open joint and of thickness to give solid backing. Backing shall fill up joint so depth of sealant bite is no more than **3/8 inch (9.5 mm)** deep.
- C. Bond Breaker:
  - 1. Install bond breaker where joint backing is not used or where backing is not feasible.
    - a. Apply bond-breaker tape in shallow joints as recommended by Sealant Manufacturer.
- D. Sealant:
  - 1. Apply sealant with hand-caulking gun with nozzle of proper size to fit joints. Use sufficient pressure to insure full contact to both sides of joint to full depth of joint. Apply sealants in vertical joints from bottom to top.
  - 2. Fill joint opening to full and proper configuration.
  - 3. Apply in continuous operation.
  - 4. Tool joints immediately after application of sealant if required to achieve full bedding to substrate or to achieve smooth sealant surface. Tool joints in opposite direction from application direction, i.e., in vertical joints, from the top down. Do not 'wet tool' sealants.
  - 5. Depth of sealant bite shall be **1/4 inch (6 mm)** minimum and **1/2 inch (12.7 mm)** maximum, but never more than one half or less than one fourth joint width.
- E. Caulk gaps between painted or coated substrates and unfinished or pre-finished substrates. Caulk gaps larger than **3/16 inch (5 mm)** between painted or coated substrates.

### 3.4 TOLERANCES

- A. Provide joint tolerances in accordance with Manufacturer's printed instructions.

### 3.5 FIELD QUALITY CONTROL

- A. Adhesion Test (Installer Option to use adhesion test to determine if primer is required).
  - 1. Perform adhesion tests in accordance with Manufacturer's instructions and ASTM C1193, Method A, Field-Applied Sealant joint Hand-Pull Tab:
    - a. Perform five (5) tests for first **1,000 linear feet (300 meters)** of applied silicone sealant and one (1) test for each **1,000 linear feet (300 meters)** seal thereafter or perform one (1) test per floor per building elevation minimum.
    - b. For sealants applied between dissimilar materials, test both sides of joints.
  - 2. Sealants failing adhesion test shall be removed, substrates cleaned, sealants re-installed, and re-testing performed.
  - 3. Maintain test log and submit report to Architect indicating tests, locations, dates, results, and remedial actions.

### 3.6 CLEANING

- A. Remove masking tape and excess sealant.
- B. Clean adjacent materials, which have been soiled, immediately (before setting) as recommended by Manufacturer.
- C. Waste Management: Dispose of products in accordance with manufacturer's recommendation.

**END OF SECTION**



**SECTION 07 9219****ACOUSTICAL JOINT SEALANTS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
1. Quality of sealants to be used at perimeters of and penetrations through acoustically insulated walls and associated ceilings.
- B. Related Requirements:
1. Section 09 2900: Furnishing and installing of acoustical sealants.

**1.2 REFERENCES**

- A. Definitions:
1. Sealant. Sealants are generally used in applications where elastic properties are needed while adhesives are generally used in applications where bonding strength and rigidity are needed. With technology advancements both sealants and adhesives can be used interchangeably depending on the applications performance requirements.
  2. Sealant Types and Classes:
    - a. Federal Specifications:
      - 1) Type I: Self-leveling, pour grade.
      - 2) Type II: Non-sag, gun grade.
      - 3) Type NS: Non-sag, gun grade.
      - 4) Class A: +25 percent, -25 percent expansion – contraction.
    - b. ASTM Specifications:
      - 1) Type S: Single-component sealant.
      - 2) Type M: Multi-component sealant.
      - 3) Grade P: Pourable or self-leveling sealant for joints on horizontal surfaces.
      - 4) Grade NS: Non-sag or gunnable sealant for joints in vertical surfaces.
      - 5) Class 25: Sealant that, when tested for adhesion or cohesion under cyclic movement shall withstand increase and decrease of at least 25 percent of joint width as measured at time of application.
      - 6) Class 12: Sealant that, when tested for adhesion and cohesion under cyclic movement shall withstand increase and decrease of at least 12 percent of joint width as measured at time of application.
      - 7) T: Sealant designed for use in joints in pedestrian and vehicular traffic areas such as walkways, plazas, decks and parking garages.
      - 8) NT: Sealant designed for use in joints in non-traffic areas.
      - 9) M: Sealant will remain adhered to mortar.
      - 10) G: Sealant will remain adhered to glass.
      - 11) A: Sealant will remain adhered to aluminum.
      - 12) O: Sealant will remain adhered to substrates other than glass, aluminum, mortar.
- B. Reference Standards:
1. ASTM International:
    - a. ASTM C834-17, 'Standard Specification for Latex Sealants'.
    - b. ASTM C919-18, 'Standard Practice for Use of Sealants in Acoustical Applications'.
    - c. ASTM C1193-16, 'Standard Guide for Use of Joint Sealants'.
    - d. ASTM E84-18b, 'Standard Test Method for Surface Burning Characteristics of Building Materials'.



- e. ASTM E90-09(2016), 'Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements'.
2. Underwriters Laboratories, Inc.:
  - a. UL 723: 'Standard for Safety Test for Surface Burning Characteristics of Building Materials'; (11th edition - 2018)'

### 1.3 SUBMITTALS

- A. Action Submittals:
  1. Product Data:
    - a. Manufacturer's literature for each Product.
- B. Informational Submittals:
  1. Certificates:
    - a. Manufacturer's Certificate:
      - 1) Certify products are suitable for intended use and products meet or exceed specified requirements.
      - 2) Certificate from Manufacturer indicating date of manufacture.
  2. Manufacturers' Instructions:
    - a. Manufacturer's installation recommendations for each Product.

### 1.4 QUALITY ASSURANCE

- A. Regulatory Agency Sustainability Approvals:
  1. Surface-Burning Characteristics:
    - a. Class A flame spread rating in accordance with ASTM E84 or UL 723 Type 1.
      - 1) Class A (Flame spread index 0-25; Smoke-developed index 0-450).

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery And Acceptance Requirements:
  1. Deliver and keep in original containers until ready for use.
  2. Inspect for damage or deteriorated materials.
- B. Storage And Handling Requirements:
  1. Handle to prevent inclusion of foreign matter, damage by water, or breakage.
  2. Store in cool, dry location, and at temperatures never under 40 deg F (4 deg C) nor exceeding 80 deg F (26.7 C).

### 1.6 FIELD CONDITIONS

- A. Ambient Conditions:
  1. Do not apply caulking at temperatures below 40 deg F (4 deg C).

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Sealants:
  1. Design Criteria:
    - a. Meet requirements of ASTM C834.
    - b. Meet Class A flame spread rating.
  2. Category Four Approved Products. See Section 01 6200 for definitions of Categories:

- a. OSI Pro-Series SC-175 Draft & Acoustical Sound Sealant by OSI Sealants Inc, Mentor, OH [www.osisealants.com](http://www.osisealants.com).
- b. QuietZone Acoustic Caulk by Owens Corning, Toledo, OH [www.owenscorning.com](http://www.owenscorning.com).
- c. Acoustical Sealant by Tremco, Beachwood, OH [www.tremcosealants.com](http://www.tremcosealants.com) or Toronto, ON (800) 363-3213.
- d. Acoustical Sound Sealant by Titebond.
- e. Acoustical Sealant by U S Gypsum, Chicago, IL [www.usg.com](http://www.usg.com).

## 2.2 ACCESSORIES

- A. Bond Breaker: Pressure sensitive tape recommended by Sealant Manufacturer to suit application.
- B. Joint Backing:
  1. Flexible closed cell polyurethane or polyolefin rod or bond breaker tape as recommended by Sealant Manufacturer for joints being sealed.
  2. Oversized 25 to 50 percent larger than joint width.
- C. Joint Cleaner: Non-corrosive and non-staining type, recommended by Sealant Manufacturer, compatible with joint forming materials.
- D. Masking Tape: Pressure sensitive tape recommended by Sealant Manufacturer to suit application.
- E. Primer: Non-staining type, type, recommended by Sealant Manufacturer to suit application.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification Of Conditions:
  1. Examine substrate surfaces and joint openings are ready to receive Work.
  2. Sealants provided shall meet Manufacturer's shelf-life requirements.
  3. Notify Architect of unsuitable conditions in writing.
    - a. Do not proceed until unsatisfactory conditions are corrected.
  4. Commencement of Work by installer is considered acceptance of substrate.

### 3.2 PREPARATION

- A. Surface Preparation:
  1. Prepare joints in accordance with ASTM C1193 and Manufacturer's instructions.
  2. Clean joint surfaces to remove dirt, dust, oils, wax, paints, and other contamination capable of affecting primer and sealant bond.
  3. Protect elements surrounding the Work of this section from damage or disfiguration. Apply masking tape to adjacent surfaces when required to prevent damage to finishes from sealant installation.
- B. Surface Preparation:
  1. Remove existing sealants where specified.
  2. Clean joint surfaces of residual sealant and other contaminates capable of affecting sealant bond to joint surface.
  3. Surfaces shall be clean, dry, and free of dust, oil, grease, dew, or frost.

### 3.3 INSTALLATION

- A. General:

1. Do not use damaged or deteriorated materials.
  2. Install primer and sealants in accordance with ASTM C1193 and Manufacturer's instructions where required for sealant adhesion.
  3. Install sealants immediately after joint preparation.
  4. Do not apply caulking/sealant at temperatures below 40 deg F (4 deg C).
- B. Joint Backing:
1. Rod for open joints shall be at least 1-1/2 times width of open joint and of thickness to give solid backing. Backing shall fill up joint so depth of sealant bite is no more than 3/8 inch (9.5 mm) deep.
  2. Apply bond-breaker tape in shallow joints as recommended by Sealant Manufacturer.
- C. Install at perimeter joints and mechanical and electrical penetrations in sound insulated rooms. Apply sealant with hand-caulking gun with nozzle of proper size to fit joints. Use sufficient pressure to insure full contact to both sides of joint to full depth of joint.
- D. Tool joints immediately after application of sealant if required to achieve full bedding to substrate or to achieve smooth sealant surface.
- E. Depth of sealant bite shall be 1/4 inch (6 mm) minimum and 1/2 inch (12.7 mm) maximum, but never more than one half or less than one fourth joint width.

### 3.4 FIELD QUALITY CONTROL

- A. Inspection:
1. Examine sealant joints to verify compliance with Contract Document requirements.
- B. Non-Conforming Work. Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
1. Sealant material found to be contaminated or damaged or inadequate preparation of substrate results in deficiencies in joint sealant adhesion is considered defective or not complying with Contract Document requirements.
  2. Correct any work found defective or not-complying with Contract Document requirements at no additional cost to Owner.

### 3.5 CLEANING

- A. General:
1. Remove sealant from adjacent surfaces in accordance with Sealant Manufacturer and Substrate Manufacturer recommendations as work progresses.
  2. Remove masking tape and any other foreign material.
  3. Clean adjacent materials that have been soiled immediately (before setting) as recommended by Manufacturer.
- B. Waste Management: Dispose of products in accordance with Sealant Manufacturer's recommendation.

**END OF SECTION**

**DIVISION 08: OPENINGS**

**08 3000 SPECIALTY DOORS AND FRAMES**

08 3110 ACCESS DOORS AND PANELS

**08 7000 HARDWARE**

08 7101 COMMON FINISH HARDWARE REQUIREMENTS

08 7108 STOPS AND HOLDERS

08 7109 ACCESSORIES

END OF TABLE OF CONTENTS



**SECTION 08 3110****ACCESS DOORS AND PANELS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Products Furnished But Not Installed Under This Section:
  - 1. Manufactured access doors.
- B. Related Requirements:
  - 1. Section 06 2001: 'Common Finish Carpentry Requirements' for Installation.

**PART 2 - PRODUCTS****2.1 MANUFACTURED UNITS**

- A. Acceptable Manufacturers:
  - 1. Babcock-Davis, Minneapolis, MN [www.babcock-davis.com](http://www.babcock-davis.com).
  - 2. The Bilco Company, New Haven, CT [www.bilco.com](http://www.bilco.com) or Bilco Canada, London, ON (519) 659-7331.
  - 3. Dur-Red Products, Cudahy, CA [www.dur-red.com](http://www.dur-red.com).
  - 4. Elmdor Stoneman, City of Industry, CA [www.elmdorstoneman.com](http://www.elmdorstoneman.com).
  - 5. Jensen Industries, Los Angeles, CA [www.jensen-ind.com](http://www.jensen-ind.com).
  - 6. Karp Associates Inc, Maspeth, NY [www.karpinc.com](http://www.karpinc.com).
  - 7. Larsen's Manufacturing Co, Minneapolis, MN [www.larsensmfg.com](http://www.larsensmfg.com).
  - 8. Mifab Manufacturing Co, Minneapolis, MN [www.mifab.com](http://www.mifab.com).
  - 9. Milcor, Bensenville, IL [www.milcorinc.com](http://www.milcorinc.com).
  - 10. Nystrom Inc, Brooklyn Park, MN [www.nystrom.com](http://www.nystrom.com).
  - 11. Williams Brothers Corporation of America, Reno, NV [www.wbdoors.com](http://www.wbdoors.com).
  - 12. Equal as approved by Architect before bidding. See Section 01 6200.
- B. Standard Ceiling or Wall Access Doors:
  - 1. Manually operated with single key operated lock, interior latch release, and continuous piano hinge hardware.
  - 2. Factory powder-coated prime finish.
  - 3. Non-Fire-Rated Insulated, Class Two Quality Standard:
    - a. KRP-150 FR or KRP-350.FR by Karp.
- C. Floor Access Doors:
  - 1. Single leaf.
  - 2. Manually operated with key operated lock, cam handle, and concealed continuous piano hinge hardware.
  - 3. Factory prime finish.
  - 4. Class Two Quality Standards:
    - a. Resilient Flooring: KAFA by Karp.
    - b. Concrete: KFD by Karp.

**PART 3 - EXECUTION: Not Used****END OF SECTION**



**SECTION 08 7101****COMMON FINISH HARDWARE REQUIREMENTS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
1. General requirements for finish hardware related to architectural wood and hollow metal doors.

**1.2 REFERENCES**

- A. Association Publications:
1. Builders Hardware Manufacturers Association (BHMA), 355 Lexington Avenue, 15th Floor, New York, NY 10017-6603, Tel: 212-297-2122 Fax: 212-370-9047, [www.buildershardware.com](http://www.buildershardware.com).
- B. Reference Standards:
1. International Code Council / American National Standards Institute:
    - a. ICC / ANSI A117.1-2009, 'Accessible and Usable Buildings and Facilities'.
  2. Underwriters Laboratories (UL):
    - a. UL 10B, 'Fire Tests of Door Assemblies' (10th Edition).
    - b. UL 10C, 'Positive Pressure Fire Tests of Door Assemblies' (Third Edition).

**1.3 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
1. Hardware Templates:
    - a. Provide hardware templates to Sections 08 1213, 08 1313, and 08 1429 within fourteen (14) days after Architect approves hardware schedule.
    - b. Supply necessary hardware installation templates to Section 06 2024 before pre-installation conference.

**1.4 SUBMITTALS**

- A. Action Submittals:
1. Product Data:
    - a. Manufacturer's cut sheets.
    - b. Two (2) copies of Manufacturer's installation, adjustment, and maintenance instructions for each piece of hardware. Include one (1) set in 'Operations And Maintenance Manual' and send one (1) set with hardware when delivered.
    - c. Copy of hardware schedule.
    - d. Written copy of keying system explanation.
  2. Shop Drawings:
    - a. Submit hardware schedule indicating hardware to be supplied.
    - b. Schedule shall indicate details such as proper type of strikeplates, spindle lengths, hand, backset, and bevel of locks, hand and degree opening of closer, length of kickplates, length of rods and flushbolts, type of door stop, and other necessary information necessary to determine exact hardware requirements.
- B. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    - a. Operations and Maintenance Data:
      - 1) Manufacturer's installation, adjustment, and maintenance instructions for each piece of hardware.
    - b. Record Documentation:



- 1) Manufacturers documentation:
  - a) Manufacturer's literature and/or cut sheets.
  - b) Include keying plan and bitting schedule.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Storage And Handling Requirements:
  1. Neatly and securely package hardware items by hardware group and identify for individual door with specified group number and set number used on Supplier's hardware schedule.
  2. Include fasteners and accessories necessary for installation and operation of finish hardware in same package.

## PART 2 - PRODUCTS

### 2.1 SUPPLIERS

- A. Existing Projects (Doors and Door Hardware):
  1. USA Projects:
    - a. Category Three Approved Suppliers. See Section 01 6200 for definitions of Categories:
      - 1) Architectural Building Supply, Salt Lake City, UT [www.cookandboardman.com](http://www.cookandboardman.com):
        - a) Contact Information: Russ Farley: phone (800) 574-4369, fax 801-484-6817, or e-mail [russf@absdoors.com](mailto:russf@absdoors.com).
      - 2) Beacon Metals Inc, Salt Lake City, UT [www.beacon-metals.com](http://www.beacon-metals.com):
        - a) Contact Information: Jared Butler: phone (801) 486-4884, cell (435) 216-2297, FAX 801-485-7647, or e-mail [Jared@beacon-metals.com](mailto:Jared@beacon-metals.com).
      - 3) Midwest D-Vision Solutions, Salt Lake City, UT [www.mwdsutah.com](http://www.mwdsutah.com).
        - a) Contact Information: Dan Mercer, office (801) 377-4355, cell (801) 618-9456, e-mail [danm@mwdsutah.com](mailto:danm@mwdsutah.com).
  - B. Hardware Finishes:
    1. Finishes for brass or bronze hardware items shall be: (**match existing hardware finish**)
      - a. ANSI / BHMA Finish Code 626.
        - 1) Description: Satin Chromium Plated.
        - 2) Base Metal: Brass. Bronze.
    2. Finishes for flat goods items may be:
      - a. ANSI / BHMA Finish Code 630.
        - 1) Description: Satin Stainless Steel.
        - 2) Base Metal: Stainless Steel (300 Series).
    3. Materials other than steel, brass, or bronze shall be finished to match appearance satin chromium plated, except flat goods which shall be satin stainless steel.

### 2.2 FASTENERS

- A. Fasteners shall be of suitable types, sizes and quantities to properly secure hardware. Fasteners shall be of same material and finish as hardware unless otherwise specified. Fasteners exposed to weather shall be non-ferrous or corrosion resisting steel.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Before ordering materials, examine Contract Documents to be assured that material to be ordered is appropriate for thickness and substrate to which it is to be secured and will function as intended.

**END OF SECTION**

**SECTION 08 7108****STOPS AND HOLDERS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Products Supplied But Not Installed Under This Section:
  - 1. Door stops.
- B. Related Sections:
  - 1. Section 08 7101: Common Hardware Requirements.

**PART 2 - PRODUCTS****2.1 MANUFACTURED UNITS**

- A. Manufacturers:
  - 1. Manufacturer Contact List:
    - a. Glynn-Johnson, Indianapolis, IN [www.glynn-johnson.com](http://www.glynn-johnson.com).
    - b. Hager, St Louis, MO [www.hagerhinge.com](http://www.hagerhinge.com).
    - c. Ives, Wallingford, CT [www.iveshardware.com](http://www.iveshardware.com).
    - d. Rockwood Manufacturing Co, Rockwood, PA [www.rockwoodmfg.com](http://www.rockwoodmfg.com).
    - e. Sargent, New Haven, CT (800) 906-6606 or (203) 562-2151 [www.sargentlock.com](http://www.sargentlock.com).
- B. Stops:
  - 1. Use wall type stops unless indicated otherwise on Door Schedule.
  - 2. Provide model appropriate for substrate. Wall stops may be either cast or wrought.
  - 3. Type Two Acceptable Products:
 

	Interior Wall	Exterior Wall	Floor Mount	Overhead.
b. Glynn Johnson	---	---	---	GJ 90S
c. Sargent	---	---	---	590S Series
d.	Equal as approved by Architect before Installation. See Section 01 6200.			

**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. Interface With Other Work: When using overhead stops, coordinate installation with door closer and other door hardware.

**END OF SECTION**



**SECTION 08 7109****ACCESSORIES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Products Furnished But Not Installed Under This Section:
  - 1. Door Silencers.
  - 2. Smoke Gaskets.
- B. Related Requirements:
  - 1. Section 08 7101: 'Common Finish Hardware Requirements' for general finish hardware requirements and Approved Suppliers.

**1.2 REFERENCES**

- A. Association Publications:
  - 1. American Architectural Manufacturers Association (AAMA):
    - a. AAMA 609 & 609-09, 'Cleaning and Maintenance Guide for Architecturally Finished Aluminum' (combined document).
    - b. AAMA 611-12, 'Voluntary Standards for Anodized Architectural Aluminum'.
    - c. AAMA 701/702-11, 'Voluntary Specification for Pile Weatherstripping and Replaceable Fenestration Weatherseals'.
  - 2. National Association of Architectural Metal Manufacturers (NAAMM):
    - a. AMP 500-06, 'Metal Finishes Manual' for Architectural and Metal Products.
- B. Reference Standards:
  - 1. American National Standards Institute / Builders Hardware Manufacturers Association:
    - a. ANSI / BHMA A156.18-2012, 'Materials and Finishes'.
    - b. ANSI / BHMA A156.21-2014, 'American National Standard for Thresholds'.
  - 2. International Code Council / American National Standards Institute:
    - a. ICC / ANSI A117.1-2009, 'Accessible and Usable Buildings and Facilities'.

**PART 2 - PRODUCTS****2.1 MANUFACTURED UNITS**

- A. Manufacturers:
  - 1. Manufacturer Contact List:
    - a. Hager, St Louis, MO [www.hagerhinge.com](http://www.hagerhinge.com).
    - b. Ives, Wallingford, CT [www.iveshardware.com](http://www.iveshardware.com).
    - c. NGP - National Guard Products, Memphis, TN [www.ngpinc.com](http://www.ngpinc.com).
    - d. Pemko Manufacturing, Ventura, CA [www.pemko.com](http://www.pemko.com).
- B. Acoustical Seals:
  - 1. Color as selected by Architect.
  - 2. Type One Acceptable Products:
    - a. Door Bottom Shoe for Metal Door:
      - 1) 779S-A by Hager.
      - 2) 35EV by NGP.
      - 3) 217AV by Pemko.

- b. Equal as approved by Architect before bidding. See Section 01 6200.
- C. Door Silencers:
  - 1. Class Two Quality Standards:
    - a. For Metal Frames:
      - 1) 307D by Hager.
      - 2) SR64 by Ives.
- D. Smoke Gaskets:
  - 1. Color as selected by Architect.
  - 2. Type One Acceptable Products:
    - a. 726 by Hager.
    - b. 5050 by NGP.
    - c. PK 55 by Pemko.
    - d. Equal as approved by Architect before bidding. See Section 01 6200.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install smoke gaskets and acoustical seals in manner to give continuous air-tight fit.
  - 1. Install smoke gaskets as per Manufacturer's installation requirements:
    - a. Hinge Jamb: Install smoke gaskets on jamb face of door frame so door will compress smoke gasket.
    - b. Header and Strike Jamb: Install smoke gaskets on face of stop of door frame so door will compress smoke gasket.
  - 2. Install acoustical seal with seal under door.

**END OF SECTION**

## **DIVISION 09: FINISHES**

### **09 2000 PLASTER AND GYPSUM BOARD**

09 2613 GYPSUM VENEER PLASTER  
09 2900 GYPSUM BOARD

### **09 5000 CEILINGS**

09 5116 ACOUSTICAL TILE CEILINGS

### **09 6000 FLOORING**

09 6816 SHEET CARPETING: BACK CUSHION, DIRECT GLUE

### **09 9000 PAINTS AND COATINGS**

09 9001 COMMON PAINTING AND COATING REQUIREMENTS  
09 9121 INTERIOR PAINTED POURED CONCRETE  
09 9122 INTERIOR PAINTED CMU  
09 9115 EXTERIOR PAINTED WOOD  
09 9125 INTERIOR PAINTED WOOD  
09 9413 INTERIOR TEXTURED FINISHING

END OF TABLE OF CONTENTS



**SECTION 09 2900****GYPSUM BOARD****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
1. Furnish and install gypsum board as described in Contract Documents, except behind ceramic tile.
  2. Furnish and install acoustical sealants as described in Contract Documents.
- B. Related Requirements:
1. Section 07 9219: 'Acoustical Joint Sealants' for quality of acoustical sealants.
  2. Section 09 9413: 'Interior Textured Finishing'.

**1.2 REFERENCES**

- A. Definitions:
1. Accessories: Metal or plastic beads, trim, or moulding used to protect or conceal corners, edges, or abutments of the gypsum board construction.
  2. Drywall Primer: Paint material specifically formulated to fill the pores and equalize the suction difference between gypsum board surface paper and the compound used on finished joints, angles, fastener heads, and accessories and over skim coatings.
  3. Skim Coat: Either a thin coat of joint compound trowel applied, or a material manufactured especially for this purpose and applied in accordance with manufacturer's recommendations, over the entire surface.
  4. Texturing: Regular or irregular patterns typically produced by applying a mixture of joint compound and water, or proprietary texture materials including latex base texture paint, to a gypsum board surface previously coated with drywall primer.
- B. Reference Standards:
1. ASTM International:
    - a. ASTM C11-18, 'Standard Terminology Relating to Gypsum and Related Building Materials and Systems'.
    - b. ASTM C475/C475M-17, 'Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board'.
    - c. ASTM C840-18a, 'Standard Specification for Application and Finishing of Gypsum Board'.
    - d. ASTM C1002-18, 'Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs'.
    - e. ASTM C1047-14a, 'Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base'.
    - f. ASTM C1178/C1178M-18, 'Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel'.
    - g. ASTM C1396/C1396M-17, 'Standard Specification for Gypsum Board'.
    - h. ASTM E84-18b, 'Standard Test Method for Surface Burning Characteristics of Building Materials'.
    - i. ASTM E119-18b, 'Standard Test Method for Fire Tests of Building Construction and Materials'.
  2. Gypsum Association:
    - a. GA-214-15, 'Recommended Levels of Gypsum Board Finish'.
    - b. GA-216-16: 'Application and Finishing of Gypsum Panel Products'.
    - c. GA-600-15, 'Fire Reference Design Manual'.



- d. GA-801-2017, 'Handling and Storage of Gypsum Panel Products: A Guide for Distributors, Retailers, and Contractors'.
3. International Building Code (IBC) (2018 or latest approved version):
  - a. Chapter 25, 'Gypsum Board And Plaster'.
4. Underwriters Laboratories, Inc.
  - a. UL 263: 'Test Method for Fire Tests of Building Construction and Materials' (14th Edition).
  - b. UL 723: 'Test for Surface Burning Characteristics of Building Materials; (11th Edition).

### 1.3 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Conference:
  1. Schedule MANDATORY pre-installation conference immediately before installation of gypsum wallboard.
  2. In addition to agenda items specified in Section 01 3100, review following:
    - a. Finish requirements necessary for installation of finish materials over gypsum wallboard, and location and installation of ceramic tile backerboard.

### 1.4 SUBMITTALS

- A. Informational Submittals:
  1. Test And Evaluation Reports:
    - a. Fire test results or assembly diagrams and numbers confirming products used will provide required fire ratings with installation configurations used.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. General:
  1. Following recommendations of GA-801 Guide for Handling and Storage of Gypsum Panel Products unless local, state or federal laws or agency rules differing from the recommendations shall take precedence.
- B. Delivery And Acceptance Requirements:
  1. Deliver materials in original packages, containers, or bundles bearing brand name, applicable standard designation, and Manufacturer's name.
- C. Storage And Handling Requirements:
  1. Store material under roof and keep dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack gypsum board flat to prevent sagging.

### 1.6 FIELD CONDITIONS

- A. Ambient Conditions:
  1. Comply with ASTM C840 or GA-216 requirements, whichever are more stringent:
    - a. Do not install interior products until installation areas are enclosed and conditioned.
      - 1) Temperature shall be 50 deg F (10 deg C) and 95 deg F (35 deg C) maximum day and night during entire joint operation and until execution of Certificate of Substantial Completion.
      - 2) Provide ventilation to eliminate excessive moisture.
      - 3) Avoid hot air drafts that will cause too rapid drying.
    - b. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

#### A. Manufacturers:

1. Manufacturer Contact List:
  - a. American Gypsum, Dallas, TX [www.americangypsum.com](http://www.americangypsum.com).
  - b. CertainTeed Gypsum, Inc; Tampa, FL [www.certainteed.com](http://www.certainteed.com).
  - c. Georgia Pacific, Atlanta, GA [www.gp.com](http://www.gp.com).
  - d. National Gypsum, Charlotte, NC [www.nationalgypsum.com](http://www.nationalgypsum.com).
  - e. Pabco Gypsum, Newark, CA [www.pabcogypsum.com](http://www.pabcogypsum.com).
  - f. United States Gypsum Co, Chicago, IL [www.usg.com](http://www.usg.com).

#### B. Materials:

1. Interior Gypsum Board:
  - a. General:
    - 1) Size:
      - a) Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
    - 2) Class Two Quality Standard:
      - a) Core: Fire-resistant rated gypsum core.
      - b) Complies with Type X requirements of ASTM C1396/C1396M (Section 5).
      - c) Surface paper: Face paper suitable for painting.
      - d) Long edges: Tapered edge.
      - e) Overall thickness: **5/8 inch (15.9 mm)**.

### 2.2 ACCESSORIES

#### A. Manufacturers:

1. Manufacturer Contact List:
  - a. Kinetics Noise Control, Dublin, OH [www.kineticsnoise.com](http://www.kineticsnoise.com).
  - b. Magnum Products, Lenaxa, KS [www.levelcoat.com](http://www.levelcoat.com).
  - c. National Gypsum, Charlotte, NC [www.nationalgypsum.com](http://www.nationalgypsum.com).
  - d. Soundproofing Co, San Marcos, CA [www.soundproofing.org](http://www.soundproofing.org).
  - e. United States Gypsum Co, Chicago, IL [www.usg.com](http://www.usg.com).
  - f. Westpac Materials Inc, Orange, CA [www.westpacmaterials.com](http://www.westpacmaterials.com).
  - g. Wm. Zinsser & Co, Somerset, NJ [www.zinsser.com](http://www.zinsser.com).
2. Gypsum Board Mounting Accessories:
  - a. Corner And Edge Trim:
    - 1) Metal, paper-faced metal, paper-faced plastic, or solid vinyl meeting requirements of ASTM C1047. Surfaces to receive bedding cement treated for maximum bonding.
  - b. Control Joint:
    - 1) Bent zinc sheet with V-shaped slot, perforated flanges, covered with plastic tape meeting requirements of ASTM C1047.
3. Joint Compound:
  - a. Best grade or type recommended by Board Manufacturer and meeting requirements of ASTM C475/C475M.
    - 1) Use Taping Compound for first coat to embed tape and accessories.
    - 2) Use Taping Compound or All-Purpose Compound for subsequent coats except final coat.
    - 3) Use Finishing Compound for final coat and for skim coat.
4. Joint Reinforcing:
  - a. Paper reinforcing tape acceptable to Gypsum Board Manufacturer.
5. Fasteners:
  - a. Bugle head screws meeting requirements of ASTM C1002:
    - 1) Gypsum Board:

- a) Type W: For fastening gypsum board to wood members, of length to penetrate wood framing **5/8 inch (15.9 mm)** minimum.
  - b) Type S: For fastening gypsum board to steel framing and ceiling suspension members, of length to penetrate steel framing **3/8 inch (9.5 mm)** minimum.
- B. Primer / Surfer On Surfaces To Receive Texturing:
1. Type Two Acceptable Products:
    - a. Sheetrock First Coat by USG.
    - b. Prep Coat by Westpac Materials.
    - c. Level Coat by Magnum Products.
    - d. Equal as approved by Architect before bidding. See Section 01 6200.
- C. Primer On Surfaces To Receive Wallcovering:
1. White, self-sizing, water based, all purpose wallcovering primer.
  2. Type Two Acceptable Products:
    - a. Shieldz Universal Pre-Wallcovering Primer by Wm. Zinsser and Company.
    - b. Equal as approved by Architect before application. See Section 01 6200.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification Of Conditions:
1. Examine substrate and verify framing is suitable for installation of gypsum board.
  2. Examine gypsum board before installation. Reject panels that are wet, moisture damaged, and mold damaged.
  3. Notify Architect of unsuitable conditions in writing.
    - a. Do not install board over unsuitable conditions.
  4. Commencement of Work by installer is considered acceptance of substrate.

### 3.2 INSTALLATION

- A. Interface With Other Work:
1. Coordinate with Division 06 for location of backblocking for edges and ends of gypsum board and for blocking required for installation of equipment and building specialties.
  2. Do not install gypsum board until required blocking is in place.
- B. General: Install and finish as recommended in ASTM C840 or GA-216 unless specified otherwise in this Section.
- C. Interior Gypsum Board:
1. General:
    - a. Install so trim and reinforcing tape are fully backed by gypsum board. No hollow spaces between pieces of gypsum board over **1/8 inch (3 mm)** wide before taping are acceptable.
    - b. Rout out backside of gypsum board to accommodate items that extend beyond face of framing, but do not penetrate face of gypsum board, such as metal door frame mounting brackets, etc.
    - c. On walls over **108 inches (2 700 mm)** high, apply board perpendicular to support
    - d. Butt edges in moderate contact. Do not force in place. Shim to level.
    - e. Leave facings true with joint, finishing flush. Vertical work shall be plumb and ceiling surfaces level.
    - f. Scribe work closely:
      - 1) Keep joints as far from openings as possible.
      - 2) If joints occur near an opening, apply board so vertical joints are centered over openings.
      - 3) No vertical joints shall occur within **8 inches (200 mm)** of external corners or openings.

- g. Install board tight against support with joints even and true. Tighten loose screws.
  - h. Caulk perimeter joints in sound insulated rooms with specified acoustical sealant.
2. Ceilings:
- a. Apply ceilings first using minimum of two (2) men.
  - b. Use board of length to give minimum number of joints.
  - c. Apply board perpendicular to support.
3. Fastening:
- a. Apply from center of board towards ends and edges.
  - b. Apply screws **3/8 inch (9.5 mm)** minimum from ends and edges, **one inch (25 mm)** maximum from edges, and **1/2 inch (13 mm)** maximum from ends.
  - c. Spacing:
    - 1) Ends: Screws not over **7 inches (175 mm)** on center at edges where blocking or framing occurs.
    - 2) Wood Framed Walls And Ceilings: Screws **7 inches (175 mm)** on center in panel field.
    - 3) Metal Framed Walls: Screws **12 inches (300 mm)** on center in panel field.
  - d. Set screw heads **1/32 inch (0.8 mm)** below plane of board, but do not break face paper. If face is accidentally broken, apply additional screw **2 inches (50 mm)** away.
  - e. Screws on adjacent ends or edges shall be opposite each other.
  - f. Drive screws with shank perpendicular to face of board
4. Trim:
- a. Corner Beads:
    - 1) Attach corner beads to outside corners.
      - a) Attach metal corner bead with staples spaced **4 inches (100 mm)** on center maximum and flat taped over edges of corner bead. Also, apply screw through edge of corner bead where wood trim will overlay corner bead.
      - b) Set paper-faced trim in solid bed of taping compound.
  - b. Edge Trim: Apply where gypsum board abuts dissimilar material. Hold channel and 'L' trim back from exterior window and door frames **1/8 inch (3 mm)** to allow for caulking.
5. Finishing:
- a. General:
    - 1) Tape and finish joints and corners throughout building as specified below to correspond with final finish material to be applied to gypsum board. When sanding, do not raise nap of gypsum board face paper or paper-faced trim.
    - 2) First Coat:
      - a) Apply tape over center of joint in complete, uniform bed of specified taping compound and wipe with a joint knife leaving a thin coating of joint compound. If metal corner bead is used, apply reinforcing tape over flange of metal corner bead and trim so half of tape width is on flange and half is on gypsum board.
      - b) Completely fill gouges, dents, and fastener dimples.
      - c) Allow to dry and sand lightly if necessary, to eliminate high spots or excessive compound.
    - 3) Second Coat:
      - a) Apply coat of specified joint compound over embedded tape extending **3-1/2 inches (88 mm)** on both sides of joint center. Use finishing compound only if applied coat is intended as final coat.
      - b) Re-coat gouges, dents, and fastener dimples.
      - c) Allow to dry and sand lightly to eliminate high spots or excessive compound.
    - 4) Third Coat: Apply same as second coat except extend application **6 inches (150 mm)** on both sides of joint center. Allow to dry and sand with fine sandpaper or wipe with damp sponge.
    - 5) Fourth Coat: Apply same as second coat except extend application **9 inches (425 mm)** on both sides of joint center. Allow to dry and sand with fine sandpaper or wipe with damp sponge.
  - a. Finishing Levels: Finish panels to levels indicated below and according to ASTM C840, GA-214 and GA-216:
    - 1) Gypsum Board Surfaces not painted or finished:

- a) GA-214 Level 1: 'All joints and interior angles shall have tape set in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable'.
- 2) Gypsum Board Surfaces Under Acoustical Tile:
  - a) GA-214 Level 2: 'All joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.
  - b) Note: It is critical that gypsum board ceiling be smooth before installing ceiling tile. Drywall joints must be as specified in paragraph above.
- 3) Gypsum Board Surfaces to Receive: Wall Covering Type A - Section 09 7226: 'Sisal Wall Covering':
  - a) GA-214 Level 3: 'All joints and interior angles shall have tape embedded in joint compound and one additional coat of joint compound applied over all joints and interior angles. Fastener heads and accessories shall be covered with two separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Coat prepared surface with specified wall covering primer'.
- 4) Gypsum Board Surfaces to Receive: Painted Texturing - Section 09 9413: 'Interior Textured Finishing':
  - a) GA-214 Level 4: 'All and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Coat prepared surface with specified primer'.
- 5) Gypsum Board Surfaces to Receive: Smooth Gypsum Board Surfaces:
  - a) GA-214 Level 4: 'All and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Coat prepared surface with specified primer'.
- 6) Painted, Untextured Gypsum Board Surfaces, Except in Mechanical, Storage, And Utility Areas:
  - a) GA-214 Level 5: 'All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. A thin skim coat of joint compound trowel applied, or a material manufactured especially for this purpose and applied in accordance with manufacturer's recommendations, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges. Coat prepared surface with specified primer'.

### 3.3 FIELD QUALITY CONTROL

#### A. Non-Conforming Work:

1. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - a. Indications that panels are wet, or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

**3.4 CLEANING**

- A. Remove from site debris resulting from work of this Section including taping compound spills.

**END OF SECTION**



**SECTION 09 5116****ACOUSTICAL TILE CEILINGS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
1. Furnish and install acoustical tile on backerboard as described in Contract Documents.
- B. Related Requirements:
1. Section 09 2900: 'Gypsum Board'.

**1.2 REFERENCES**

- A. Association Publications:
1. The Ceilings & Interior Systems Construction Association (CISCA), 405 Illinois Avenue, 2B, St Charles IL. [www.cisca.org](http://www.cisca.org).
    - a. '*Ceiling Systems Handbook*': Recommendations for direct hung acoustical tile installation.
    - b. '*Production Guide*': Practical reference for ceiling systems and estimating costs.
- B. Definitions:
1. Absorption: Materials that have capacity to absorb sound. Absorption is the opposite of reflection.
  2. Ceiling Attenuation Class (CAC): Rates ceiling's efficiency as barrier to airborne sound transmission between adjacent closed offices. Shown as minimum value, previously expressed as CSTC (Ceiling Sound Transmission Class). Single-figure rating derived from normalized ceiling attenuation values in accordance with classification ASTM E413, except that resultant rating shall be designated ceiling attenuation class. (Defined in ASTM E1414.) Acoustical unit with high CAC may have low NRC.
  3. Class A: Fire classification for product with flame spread rating of no more than 25 and smoke developed rating not exceeding 50, when tested in accordance with ASTM E84 or UL 723.
  4. Flame Spread: The propagation of flame over a surface.
  5. Flame Spread Index: Comparative measure, expressed as a dimensionless number, derived from visual measurements of the spread of flame versus time for a material tested in accordance with ASTM E84 or UL 723.
  6. Light Reflectance (LR): Percentage of light a surface reflected by ceiling surface expressed in decimal form.
  7. Noise Reduction Coefficient (NRC): Average sound absorption coefficient measured at four frequencies: 250, 500, 1,000 and 2,000 Hertz expressed to the nearest integral multiple of 0.05. Rates ability of ceiling or wall panel or other construction to absorb sound. NRC is fraction of sound energy, averaged over all angles of direction and from low to high sound frequencies that is absorbed and not reflected.
  8. Smoke-Developed Index: Comparative measure, expressed as a dimensionless number, derived from visual measurements of smoke obscuration versus time for a material tested in accordance with ASTM E84 or UL 723.
  9. Sound Absorption: Property possessed by materials and objects, including air, of converting sound energy into heat energy. Sound wave reflected by surface always loses part of its energy. Fraction of energy that is not reflected is called sound absorption coefficient of reflecting surface. For instance, if material reflects 80 percent of sound energy, then sound absorption coefficient would be 20 percent (0.20).
  10. Surface Burning Characteristic: Rating of interior and surface finish material providing indexes for flame spread and smoke developed, based on testing conducted according to ASTM Standard E84 or UL 723.



11. Textured Pattern: Granular or raised (fine, coarse, or a blend), felted or matted surface as an integral part of the basic product or superimposed on the product surface.

C. Reference Standards:

1. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (AASHRA):
  - a. ASHRAE Standard 62.1-2013, 'Ventilation for Acceptable Indoor Air Quality'.
2. ASTM International;
  - a. ASTM D1779-98(2017), 'Standard Specification for Adhesive for Acoustical Materials'.
  - b. ASTM E84-18b, 'Standard Test Method for Surface Burning Characteristics of Building Materials'.
  - c. ASTM E795-16, 'Standard Practices for Mounting Test Specimens During Sound Absorption Tests'.
  - d. ASTM E1264-14, 'Standard Classification for Acoustical Ceiling Products'.
  - e. ASTM E1414/E1414-16, 'Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum'.
  - f. ASTM E1477 - 98a(2017), 'Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers'.
3. International Building Code (IBC) (2018 or latest approved Edition):
  - a. Chapter 8, 'Interior Finishes':
    - 1) Section 803, 'Wall And Ceiling Finishes':
      - a) 803.1.1, 'Interior Wall and Ceiling Finish Materials'.
      - b) 803.1.2, 'Room Corner Test for Interior Wall or Ceiling Finish Materials'.
4. National Fire Protection Association:
  - a. NFPA 101: 'Life Safety Code' (2018 Edition).
  - b. NFPA 265: 'Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile Coverings on Full Height Panels and Walls' (2015 Edition).
5. Underwriters Laboratories Inc.:
  - a. UL 723, 'Standard for Safety Test for Surface Burning Characteristics of Building Materials' (Tenth Edition).

### 1.3 SUBMITTALS

A. Action Submittals:

1. Samples:
  - a. One (1) sample of each variant of specified tile series.

B. Informational Submittals:

1. Certificates:
  - a. Installer(s):
    - 1) Provide each Installer's 'Certificate of Completion - Duratile' from Manufacture showing Name and completion date with bid to be included in closing documents for project.
      - a) Certificate is valid for two (2) years from date printed on Certificate before recertification is required.
2. Test And Evaluation Reports:
  - a. If requested by Owner, provide copies of Quality Assurance requirements for 'Class A' flame spread rating and 'Room-Corner Test'.
3. Manufacturer Installations:
  - a. Published installation recommendations.
4. Qualification Statement:
  - a. Installer(s):
    - 1) Provide Qualification documentation unless waived by Owner.

C. Closeout Submittals:

1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
  - a. Warranty Documentation:
    - 1) Include final, executed copy of warranty.
  - b. Record Documentation:
    - 1) Manufacturers Documentation:
      - a) Manufacturer's literature on tile and adhesive.

- b) Color and pattern selection.
  - 2) Installer(s) 'Certificate of Completion - Duratile' submitted at time of bid.
- D. Maintenance Material Submittals:
- 1. Extra Stock Materials:
    - a. Provide Owner with one (1) carton of each type of tile with same dye lot code.

#### 1.4 QUALITY ASSURANCE

- A. Regulatory Agency Sustainability Approvals:
- 1. Fire-Test-Response Characteristics: As determined by testing identical ceiling tile applied with identical adhesives to substrates according to test method indicated below by qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    - a. Surface-Burning Characteristics:
      - 1) Ceiling tile shall have Class A flame spread rating in accordance with ASTM E84 or UL 723 Type 1.
        - a) Class A (Flame spread index 0-25; Smoke-developed index 0-450).
        - b) Flash point: None.
    - 2. Passage of 'Room-Corner Test' as recognized by AHJ, is required for system. Adhesive cited in test literature is required for installation of ceiling tile on Project.
      - a. Room Corner Tests:
        - 1) ASTM E84, 'Standard Test Method for Surface Burning Characteristics of Building Materials'.
        - 2) IBC 803.2.1, 'Room Corner Test for Interior Wall or Ceiling Finish Materials'.
        - 3) NFPA 265: 'Room Corner Test for Interior Wall or Ceiling Finish Materials'.
        - 4) UL 723, 'Standard for Safety Test for Surface Burning Characteristics of Building Materials'.
- B. Qualifications:
- 1. Installer: Requirements of Section 01 4301 applies, but not limited to following:
    - a. Minimum five (5) years satisfactorily completed projects of comparable quality, similar size, and complexity including a minimum of three (3) years of experience in glue-up ceiling tile installations and shall have satisfactorily completed glue-up installation(s) within in past three (3) years before bidding.
    - b. Review, understand, and comply Installer Qualifications and submitted 'Duratile' published installation recommendations provided by Manufacturer:
      - 1) Contact Armstrong CSA customer service center at (800) 442-4212 to obtain and review compliance package on Duratile prior to bidding.
      - 2) This requirement may be waived by Owner, if Installer has previously complied with Installer Qualification requirements and can document at least two (2) satisfactorily completed projects of comparable size using Armstrong 12 inch x 12 inch (300 mm x 300 mm) ceiling tile for glue-up within past three (3) years prior to bidding.
      - 3) Installer shall note complete compliance with Qualification requirements on submitted bid form.
      - 4) Submit qualification documentation unless waived by Owner.
    - c. Agree to complete and pass 'Duratile Personal Learning Module' (Certificate required for all Installer(s) for Church projects). Certification valid for two (2) years:
      - 1) Go to <http://www.armstrong.com/commceilingsna/#>.
      - 2) Click on My Armstrong Upper Right hand Corner.
      - 3) First time users: Click on 'Register' button and provide all appropriate information for username and password (you must register as a contractor to have access to 'ELearning System').
      - 4) Under My Armstrong Functions (left hand side), click on 'ELearning System'.
      - 5) Click on 'Duratile Video'.
      - 6) Watch video and take Quiz (10 questions). Passing grade required for certificate.
      - 7) Print Certificate.
      - 8) Certificate must be submitted with Bid.
      - 9) Submit 'Certificate of Completion - Duratile'. Required for all projects and may not be waived by Owner.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Acceptance Requirements:
  - 1. Materials shall be delivered in original, unopened packages with labels intact.
- B. Storage And Handling Requirements:
  - 1. Store materials where protected from moisture, direct sunlight, surface contamination, and damage.
  - 2. Store acoustic tile in cool, dry location, out of direct sunlight and weather, and at temperatures between 32 deg F (0 deg C) and 86 deg F (30 deg C).
  - 3. Store adhesive on site at installation temperature, between 65 and 90 deg F (18 and 32 deg C), for one week before installation.
  - 4. Handle acoustical ceiling tiles carefully to avoid chipping edges or damage. Use no soiled, scratched, or broken material in the Work.

## 1.6 FIELD CONDITIONS

- A. Ambient Conditions:
  - 1. Building shall be enclosed, mechanical system operating with proper filters in place, and temperature and humidity conditions stabilized within limits under which Project will operate before, during, and after installation until Substantial Completion.
  - 2. Temperature at time of setting tile shall be 50 deg F (10 deg C) minimum and 100 deg F (38 deg C) maximum.

## 1.7 WARRANTY

- A. Manufacturer Warranty:
  - 1. Provide Manufacturer's ten (10) year limited system warranty for the following:
    - a. Manufacturer's warranty to be free from defects in materials and factory workmanship.
    - b. Manufacturer's warranty against sagging and warping.
    - c. Manufacturer's warranty against mold/mildew, and bacterial growth.
  - 2. Provide Manufacturer's system warranty for the following:
    - a. Manufacturer's warranty to be free from defects in materials and factory workmanship.

## PART 2 - PRODUCTS

### 2.1 SYSTEM

- A. Manufacturers:
  - 1. Manufacturer Contact List:
    - a. Armstrong World Industries, Strategic Accounts, Lancaster, PA [www.ceiling.com](http://www.ceiling.com).
      - 1) For pricing and ordering of tile, contact Sherry Brunt, Phyllis Miller, or Beth Rinehart at (800) 442-4212, or [Armstrongcsa@armstrong.com](mailto:Armstrongcsa@armstrong.com).
      - 2) For Strategic Account information, contact Deborah Pickens at (480) 695-9053 [dlpickens@armstrong.com](mailto:dlpickens@armstrong.com).
    - b. Franklin International, Inc., Columbus, OH [www.titebond.com](http://www.titebond.com).
  - 2. Manufacturer Contact List:
    - a. Armstrong World Industries, Strategic Accounts, Lancaster, PA [www.armstrong.com](http://www.armstrong.com).
      - 1) For pricing and ordering of tile, contact Sherry Brunt, Phyllis Miller, or Beth Rinehart at (800) 442-4212, or [Armstrongcsa@armstrong.com](mailto:Armstrongcsa@armstrong.com).
      - 2) For Strategic Account information, contact Deborah Pickens at (480) 695-9053 [dlpickens@armstrong.com](mailto:dlpickens@armstrong.com).
    - b. Franklin International, Inc, Columbus, OH [www.titebond.com](http://www.titebond.com).
    - c. USG Inc, Chicago, IL [www.usg.com](http://www.usg.com).

## B. Materials:

1. Description:
  - a. Size: **3/4 inch (19 mm)** thick minimum by **12 inches (300 mm)** square.
  - b. Color: White.
  - c. Grid Face: Tile glue-up.
  - d. Surface Finish: Factory-applied.
  - e. Wet-formed high density mineral fiber.
2. Design Criteria:
  - a. Meet requirements of ASTM E1264, Type III (mineral base with painted finish), Form 2 (water felted), Pattern CE (perforated, small holes – lightly textured), Fire Class A.
  - b. Acoustics:
    - 1) Noise Reduction Coefficient (Rating expressed according to ASTM E1284 requirements:
      - a) NRC rating: 60 minimum.
      - 2) CAC rating: 35 minimum.
  - c. Anti Mold / Mildew:
    - 1) Resistance against growth of mold/mildew.
  - d. Durable:
    - 1) Impact-resistant.
    - 2) Scratch-resistant.
  - e. Tongue and Groove.
  - f. Finish:
    - 1) Abuse-resistant/durable, factory applied vinyl latex paint.
  - g. Fire Performance:
    - 1) Panels meet ASTM E84 or UL 723 Type 1 surface burning characteristics.
  - h. High Recycled Content (HRC): Classified as containing greater than 50 percent total recycled content.
  - i. Light Reflectance (LR): 0.86 Average (Range of 0.84 to 0.88).
  - j. Sag Resistance:
    - 1) Resistance to sagging in high humidity conditions up to, but not including, standing water and outdoor applications.
  - k. Texture: Embossed texture with fine fissuring and small perforations with natural variation in texture and color appearance between tile.
  - l. VOC Emissions:
    - 1) Low formaldehyde: Contributing less than 13.5 ppb in typical conditions per ASHRAE Standard 62, 'Ventilation for Acceptable Indoor Air Quality'.
3. Acoustic Tile:
  - a. Category Three Approved Products. See Section 01 6200 for definitions of Categories:
    - 1) Duratile Item No. MN80377 by Armstrong.

## C. Materials:

1. Description:
  - a. Size: **3/4 inch (19 mm)** thick minimum by **12 inches (305 mm)** square.
  - b. Color: White.
  - c. Grid Face: Tile glue-up.
  - d. Surface Finish: Factory-applied.
  - e. Wet-formed high density mineral fiber.
2. Design Criteria:
  - a. Armstrong:
    - 1) Meet requirements of ASTM E1264, Type III (mineral base with painted finish), Form 2 (water felted), Pattern CE (perforated, small holes – lightly textured), Fire Class A.
    - 2) Meet requirements of ASTM E1264, Type III (mineral base with painted finish), Form 1 (nodular), Pattern E (lightly textured) or Pattern F (heavily textured), Fire Class A.
  - b. USG:
    - 1) Meet requirements of ASTM E1264, Type III (mineral base with painted finish), Form 4 (cast or molded), Pattern D (Fissured), Fire Class A.
  - c. Acoustics:
    - 1) Noise Reduction Coefficient (Rating expressed according to ASTM E1284 requirements:
      - a) NRC rating: 60 minimum.

- 2) CAC rating:
  - a) Armstrong: 35 minimum.
  - b) USG: 25 minimum.
- d. Anti Mold / Mildew:
  - 1) Resistance against growth of mold/mildew.
- e. Durable:
  - 1) Impact-resistant.
  - 2) Scratch-resistant.
- f. Finish:
  - 1) Abuse-resistant/durable, factory applied vinyl latex paint.
- g. Fire Performance:
  - 1) Panels meet ASTM E84 or UL 723 Type 1 surface burning characteristics.
- h. High Recycled Content (HRC): Classified as containing greater than 50 percent total recycled content.
- i. Light Reflectance (LR): 0.79 minimum.
- j. VOC Requirements:
  - 1) Armstrong:
    - a) Low formaldehyde: Contributing less than 13.5 ppb in typical conditions per ASHRAE Standard 62, 'Ventilation for Acceptable Indoor Air Quality'.
  - 2) USG:
    - a) Zero.
- 3. Acoustic Tile:
  - a. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
    - 1) 'F' Fissured by USG.

#### D. Accessories:

- 1. Adhesive:
  - a. Description:
    - 1) For use on acoustical ceiling tiles.
  - b. Design Criteria:
    - 1) Meet requirements of ASTM D1779.
    - 2) Meet NFPA Class A fire rating when tested in accordance with ASTM E84.
    - 3) Fast grab and 'no sag' installation.
    - 4) Water cleanup.
    - 5) Not recommended for use on tiles larger than **12 inch x 12 inch (305 mm x 305 mm)**.
  - c. Type Two Acceptable Products:
    - 1) Titebond No. 2704 Solvent Free Acoustical Ceiling Tile Adhesive by Franklin International.
    - 2) Highest quality of adhesive from manufacturer recommended by Tile Manufacturer as approved by Architect before use. See Section 01 6200.
- 2. Edge Molding:
  - a. Steel 'U' molding with baked enamel finish.
  - b. Type Two Acceptable Products:
    - 1) 7843 Series by Armstrong.
    - 2) Equal as approved by Architect before installation. See Section 01 6200.
    - 3) US 12 RWS 14 by USG Interiors.
    - 4) Equal as approved by Architect before installation. See Section 01 6200.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

#### A. Verification Of Conditions:

- 1. Inspect for defects in backing and support that are not acceptable.
  - a. Examine areas around HVAC diffusers and light fixtures for tile installation problems.
  - b. Examine ceiling for levelness. CISCA 'Code of Practice' requires ceiling to be free of irregularities and be level to within 1/4 inch (6 mm) in 12 foot (305 mm).
  - c. Examine substrate for any problems that will compromise adhesion of ceiling tile.

2. Notify Architect in writing of unacceptable conditions.
3. Do not apply ceiling tile until defects in backing and support are corrected.

### 3.2 PREPARATION

- A. Surface Preparation:
1. Follow Manufacturer recommendations for surface preparation:
    - a. Substrate must be clean, free of grease and dirt, sound, smooth, even and level before applying tile to surface.
      - 1) Do not install new ceiling tile over old glue globs or bad substrate with any surface finish that is incompatible with tile adhesive.
    - b. Painted Surfaces: Avoid applying tile to newly painted ceiling.
    - c. Materials shall be dry and clean at time of application.

### 3.3 INSTALLATION

- A. Special Techniques:
1. Installation shall be in accordance with Manufacturer's recommendations:
    - a. Do not install tile when room temperature exceeds or below recommended ambient conditions.
    - b. Tile is directional tile and must be installed in same direction of pattern running parallel to long dimension of each room.
    - c. Remove loose dust from back of tile and ceiling where adhesive is to be applied.
    - d. Prime **3 inch (75 mm)** minimum circle near each corner by buttering very thin coat of adhesive.
    - e. Apply daub of adhesive to each corner. Daubs will be of sufficient size to form a circle **2-1/2 to 3 inches (63 to 75 mm)** in diameter and **1/8 to 1/4 inch (3 to 6 mm)** thick when tile is pressed firmly in place. Do not apply daubs so far in advance of installation that adhesive skins over.
    - f. Do not bend tile during installation.
  2. Tile Layout:
    - a. Lay out tile symmetrically about center lines of room.
    - b. Lay out so tiles at room perimeters are at least **1/2** full tile size.
    - c. Leave tile in true plane with straight, even joints.
    - d. Tile joints shall be straight and in alignment, and exposed surface flush and level.
    - e. Furnish and install specified molding wherever tile has exposed edges or abuts walls, columns, and other vertical surfaces, except at curves of **3 inch (75 mm)** radius or smaller.
    - f. Cut around penetrations that are not to receive moldings cleanly with sharp knife and at a slight angle away from cutout.
  3. Ceiling mounted items:
    - a. Locate light fixtures, speakers, and mechanical diffusers and grilles symmetrically in room and centered on tile centers or tile joints insofar as possible, unless shown otherwise.
    - b. Keep method of locating ceiling mounted items as consistent as possible throughout building.
    - c. Ceiling mounted item location method within each room shall always be consistent.

### 3.4 FIELD QUALITY CONTROL

- A. Non-Conforming Work:
1. Acoustical Tile. The following have been identified by the Manufacturer as tile defects, should not be installed, and will be replaced at no charge to Owner. Manufacturer will replace any material that does not meet product specifications. Installer to call 1 (800) 442-4212 immediately to report any tile discrepancies:
    - a. Obvious Tile Defects:
      - 1) Gross surface defects or damage.
      - 2) Gross damage to edges and corners.

- 3) Bevels without paint.
  - b. Size Measurement:
    - 1) Tiles measure **12 inches (305 mm)**, plus or minus **1/32 inch (0.8 mm)**, measured across center of two (2) parallel sides.
  - c. Squareness Measurement:
    - 1) Measure two (2) diagonals of an individual ceiling tile.
    - 2) Diagonal measurements need to be within **1/16 inch (1.6 mm)** of each other. No more than **1/16 inch (1.6 mm)** difference.
  - d. Warp:
    - 1) Tiles specification is plus or minus **0.050 inch (1.27 mm)** as measured in the center of tile.
2. Installer:
    - a. Substrate preparation and installation of ceiling tile not following CISCA Code of Practice will be unacceptable and considered defective and subject to replacement at no cost to Owner.

### 3.5 ADJUSTING

- A. 'Touch-up' minor abraded surfaces.

### 3.6 CLEANING

- A. Remove from site debris connected with work of this Section.

**END OF SECTION**

**SECTION 09 6816****SHEET CARPETING: Back Cushion, Direct Glue****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes But Is Not Limited To:
1. Coordination, sequencing, and scheduling for installation of Owner-Furnished carpet, carpet base, carpet accessories, leveling compounds as described in Contract Documents and including following:
    - a. Pre-Installation Conference held in conjunction with Section 09 6813.
    - b. Maintain Building Ambient Conditions including normal levels of humidity, lighting, heating, and air conditioning for acceptability for beginning floor preparation and carpet installation held.
    - c. Provide disposal dumpster.
    - d. Protection of carpet after installation of carpeting as required.
- B. Products Installed But Not Furnished Under This Section:
1. Carpet Tile.
- C. Related Requirements:
1. Section 01 0000: 'General Requirements':
    - a. Section 01 1200: 'Multiple Contract Summary' for carpet tiles and carpet base excluded from Contract and furnished and installed by Owner. This Section establishes quality of materials and installation for information of Contractor and Owner's Representatives.
    - b. Section 01 3100: 'Project Management and Coordination' for pre-installation conference.
    - c. Section 01 4000: 'Quality Requirements' for administrative and procedural requirements for quality assurance and quality control.
    - d. Section 01 4301: 'Quality Assurance – Qualifications' establishes minimum qualification levels required.
    - e. Section 01 7800: 'Closeout Submittals'.
  2. Section 09 0503: 'Flooring Substrate Preparation' for:
    - a. Floor substrate preparation.
    - b. Removal of furniture from rooms and areas of new carpet.
    - c. Pre-installation conference for Sections under 09 6000 heading 'Flooring'.

**1.2 REFERENCES**

- A. Association Publications:
1. The Carpet and Rug Institute (CRI), Dalton, GA [www.carpet-rug.org](http://www.carpet-rug.org). Standard for Installation Specification of Commercial Carpet:
    - a. CRI Carpet Installation Standard – 2011 (First Edition).
    - b. CRI Indoor Air Quality (IAQ):
      - 1) CRI Green Label Plus Certification.
- B. Reference Standards:
1. The Carpet and Rug Institute (CRI):
    - a. CRI 104, 'Standard For Installation of Commercial Carpet' (Sept 2015).
    - b. CRI TM-102, 'School Carpet Minimum Average Specifications'.



### 1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate completion of flooring installation with other trades.
- B. Scheduling:
  - 1. Owner's Representative to notify Flooring Installer when Building Ambient Conditions requirements are met before installation of flooring system.
  - 2. Owner's Representative to coordinate installation of carpet.

### 1.4 SUBMITTALS

- A. Informational
  - 1. Manufacturer Instructions:
    - a. Published installation instructions.
- B. Closeout Submittals:
  - 1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    - a. Warranty Documentation:
      - 1) Copy of Warranty.
    - b. Record Documentation:
      - 1) Owner will provide Project Carpet Request Documentation forms in both hard copy and digital format:
        - a) Carpet Request Information Sheet.
        - b) Carpet Vendor Quotation.
        - c) Carpet Preinstallation Meeting Agenda.
        - d) Carpet Installation Notice to Proceed or Cancel.
        - e) Carpet Inspection and Completion.
        - f) Carpet Overage Report and Completion.
        - g) Carpet Quotation Change Request.
- C. Maintenance Material Submittals:
  - 1. Extra Stock Materials:
    - a. Leave excess pieces of carpet, **6 feet square (1 800 sq mm)** or larger, and **25 lineal feet (7.62 m)** minimum of carpet cove base.
    - b. Roll up and tie securely.

### 1.5 QUALITY ASSURANCE

- A. Qualifications: Section 01 4301 applies, but is not limited to following:
  - 1. Carpet Installer Qualifications:
    - a. Certified CFI Master or Contract II grade installer or FCIB certified.
    - b. Not less than five (5) years of experience in installation of commercial carpet tile of type, quantity and installation methods similar to work of this section.
    - c. Qualified and approved by Carpet Manufacturer.
  - 2. Carpet Manufacturer Qualifications:
    - a. Not less than five (5) years of production experience, whose published literature clearly indicates general compliance of products with requirements of this section.
    - b. Category One Approved Carpet Manufacturers:
      - 1) Approval subject to agreement process approval.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. General:
  - 1. Comply with instructions and recommendations of Manufacturer for special delivery, storage, and handling requirements.

- B. Delivery And Acceptance Requirements:
1. Deliver materials and accessories necessary for completion of carpet installation to site before beginning installation of carpet.
  2. Do not deliver materials before date scheduled for installation.
  3. Transport carpet in manner that prevents damage and distortion. Bending or folding individual carpet rolls or cuts from rolls is not recommended. When bending or folding is unavoidable for delivery purposes, carpet is required to be unrolled and allowed to lie flat immediately upon arrival at installation site.
- C. Storage And Handling Requirements:
1. Store carpet and related materials in climate-controlled, dry space.
  2. Protect carpet from soil, dust, moisture and other contaminants and store on flat surface.
  3. Stacking heavy objects on top of carpet rolls or stacking more than three rolls is prohibited.

## 1.7 FIELD CONDITIONS

- A. Ambient Conditions:
1. Building Conditions:
    - a. Conditions inside building shall be brought to levels to be normal at occupancy of building. Conditions include normal levels of humidity, lighting, heating, and air conditioning. (HVAC must be in operation thru out carpet installation):
      - 1) Carpet installation is not to begin until HVAC system is operational and following conditions are maintained for at least forty-eight (48) hours before, during and seventy-two (72) hours after completion:
        - a) Carpet is to be installed when indoor temperature is between 65° - 95° F (18° - 35° C) with maximum relative humidity of 65%.
        - b) Substrate surface temperature should not be less than 65° F (18° C) at time of installation.
        - c) Do not allow temperature of indoor carpeted areas to fall below 50° F (10° C), regardless of age of installation.
      - 2) Maintain fresh air ventilation after installation for seventy-two (72) hours minimum or until lingering odors are gone.
  2. Concrete Slab:
    - a. General:
      - 1) Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive.

## 1.8 WARRANTY

- A. Manufacturer Warranty:
1. Provide Carpet Manufacturer's standard Warranty which includes following:
    - a. Warranty shall cover defects in installation, workmanship, and installation materials.
    - b. Warranty includes specific workmanship warranties for delamination, edge raveling, fuzzing, pilling, and other textural changes which can be controlled through proper manufacturing (no fraying, zippering, delamination, edge raveling, fuzzing, pilling in carpet is acceptable for any reason).
    - c. Warranty terms will include inspection of defective area within fifteen (15) days of receipt of written notice from Owner and completion of corrective work within forty-five (45) days, unless other arrangements are made in writing with Owner on case-by-case basis.
    - d. Carpet defect or installation defect:
      - 1) Carpet Manufacturer may use any reasonable means to cure first three (3) breaches of warranty affecting an area of carpeting bounded by natural breaks such as doorways, stairs, rostrum and platform / stage ('affected carpet area'). Such cure must preserve as uniform a blended appearance, acceptable to Carpet Manufacturer and Owner, as exists throughout Installation Site at time of breach.
      - 2) If carpet defect or installation defect continues to appear after three (3) separate notices for correction from Owner, replace carpet where defects have occurred.

- e. If Carpet Manufacturer follows installation requirements of Section 09 0503 'Floor Substrate Preparation' Carpet Manufacture accepts liability of carpet installation for said given time as outlined in Special Warranty regardless of any climate or condition changes affecting RH levels of floor substrate.
- 2. Special Warranty:
  - a. Sheet Carpeting:
    - 1) General:
      - a) Appearance Retention to be provided with Special Warranty requirements if not already included in Standard Warranty.
    - 2) Meetinghouse, Mission Office, and O&M / R&I:
      - a) Owner Carpet Program Product: Provide twenty (20) year minimum or Carpet Manufacturer's better Warranty on carpet system.
    - 3) CES, S&I Module, and O&M / R&I:
      - a) Institute:
        - (1) Owner Carpet Program Product: Provide twenty-five (25) year minimum or Carpet Manufacturer's better Warranty on carpet system.
      - b) Seminary:
        - (1) Owner Carpet Program Product: Provide twenty-five (25) year minimum or Carpet Manufacturer's better Warranty on carpet system.

## PART 2 - PRODUCTS

### 2.1 OWNER-FURNISHED PRODUCTS

- A. Category One Approved Manufacturers. See Section 01 6200 for definitions of Categories:
  - 1. Materials supplied for carpet installation shall be complete package from specified Carpet Manufacturer:
    - a. Lees, Division of Mohawk Carpets, Glasgow, VA:
      - 1) Contact Information: Help Line (800) 523-5555 or (801) 397-5626.
    - b. Mannington Commercial Carpets, Calhoun, GA:
      - 1) Contact Information: Help Line Voice Mail (800) 241-2262, ext 8045 or Mannington Installation Services, email [lds@mannington.com](mailto:lds@mannington.com) or (855) 466-2664.
    - c. Tandus Centiva., Dalton, GA [www.tandus-centiva.com](http://www.tandus-centiva.com).
      - 1) Contact Information: Tracy Riddle - cell (801) 580-5147 fax (866) 861-7522  
[Tracy.Riddle@Tarkett.com](mailto:Tracy.Riddle@Tarkett.com).
- B. Materials:
  - 1. Carpet:
    - a. Category One Approved Manufacturer and Color / Patterns. See Section 01 6200 for definitions of Categories:
      - 1) Mannington:
        - a) New Horizon, Color: New Grove.
        - b) New Horizon, Color: New Medallion.
        - c) New Horizon, Color: New Seasons.
        - d) New Horizon, Color: New Ocean
      - 2) Mohawk:
        - a) Nauvoo II, Color: 407 Columbine II.
        - b) Nauvoo II, Color: 121 Forest II.
        - c) Nauvoo II, Color: 405 Bountiful II.
        - d) Nauvoo II, Color: 417 Meadow II.
      - 3) Tandus Centiva:
        - a) Style 04425 Ensign II, Color: Emerald II #85669.
        - b) Style 04346 Ensign II, Color: Garnet II #81096.
        - c) Style 04448 Ensign II, Color: Jasper II #85670.
        - d) Style 04346 Ensign II, Color: Sapphire II #86653.
  - 2. Carpet Base:
    - a. 4-1/2 inch (115 mm) wide base without cushion backing:
      - 1) Top edge of base serged with 1-1/4 inch (32 mm) polyester binding fabric.

- 2) Roll edges of binding fabric under and sew along top edge of carpet cove base.
- b. Carpet:
  - 1) Category One Approved Products. See Section 01 6200 for definitions of Categories:
    - a) Mannington: Ultrabac RE, Color: Black.
    - b) Bigelow Commercial (Mohawk): Spectrum V30, Color: 7234 Ebony Domino.
    - c) Tandus Centiva: Abrasive Action II, Color: Winter Gray 19103.

## 2.2 ACCESSORIES

- A. Carpet Accessories: Snap-in vinyl reducer strips and vinyl track.
- B. Floor Leveling Compound, Floor Patching Compound, And Latex Underlayment: As recommended and approved by Carpet Manufacturer:

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions:
  1. Verify required ambient conditions inside building for required normal levels of humidity, lighting, heating, and air conditioning have been maintained for at least forty-eight (48) hours before and during carpet installation and seventy-two (72) after installation of carpet.
- B. Evaluation And Assessment:
  1. Carpet Areas:
    - a. Variation In Grade:
      - 1) Plus or minus **1/8 inch (3 mm)** in any **10 foot (3 meter)** of floor slab and distance between high point and low point of slab of **1/2 inch (13 mm)**.
    - b. Testing Procedure:
      - 1) Place ends of straightedge on **3/8 inch (10 mm)** high shims.
      - 2) Floor is satisfactory if **1/4 inch (6 mm)** diameter steel rod rolled under straightedge will not touch anywhere along **10 foot (3 meter)** length and **1/2 inch (13 mm)** diameter steel rod will not fit under straightedge anywhere along **10 foot (3 meter)** length.
    - c. Notify Owner's Representative in writing if floor surface is not acceptable to install carpet:
    - d. Do not lay carpet over unsuitable surface. Commencing installation constitutes acceptance of floor and approval of existing conditions.

### 3.2 PREPARATION

- A. Furniture Removal:
  1. Remove existing seating, and store in location as directed by Owner.
  2. Protect stored furniture items from dust, dirt, and damage related to other installation activities.
- B. Carpet Areas:
  1. Flooring Preparation:
    - a. Owner-Furnished Product Supplier's Responsibility:
      - 1) Prepare floor substrate in accordance with 'CRI Carpet Installation Standard' best practices to receive carpet installation and to provide installation that meets warranty requirements.
      - 2) Verify concrete surface cured, clean, dry, and free of foreign substances that will compromise carpet and/or installation.
    - b. Concrete floor slab patching:
      - 1) Cracks, chips and joints must be properly patched or repaired.
    - c. Concrete surface cured, clean, dry, and free of foreign substances that will compromise carpet and/or other flooring installations:

- 1) Removal of curing compounds.
- 2) Remove paint, sealer, grease, oil, silicone sealants, and other materials incompatible with flooring adhesives.
- 3) Removal of overspray from painted walls (essential so glue will stick).
- d. Vacuum and damp mop floor areas to receive flooring before flooring installation.
2. Relaxing / Conditioning Carpet:
  - a. Highly recommended that carpet be unrolled and allowed to relax in installation area for time period that conforms to requirements of manufacturer of product being installed:
  - b. Protect carpet adequately from soil, dust, moisture and other contaminants.
  - c. Sundry items, such as adhesives, should also be conditioned.
3. Carpet Accessories:
  - a. Owner-Furnished Product's Responsibility:
    - 1) Sundry items, such as adhesives, shall be conditioned to building ambient conditions before use.

### 3.3 INSTALLATION

- A. Carpet:
  1. General:
    - a. Install carpet and carpet base in accordance with CRI Carpet Installation Standard (2009) and manufacturer's written instructions supplied with product.
    - b. Adhesion of carpet cushion (or secondary backing) to floor substrate and adhesion of carpet primary and secondary backings shall be continuous on floor surface so there is no bubble, ridges, or any separation of carpet from backings or backing from floor substrate caused by failure of carpet, backings or cushion, and adhesives as a system.
    - c. Install carpet under edge of metal thresholds where possible. Use specified carpet accessories at exposed edges.
  2. Seaming Requirements:
    - a. Seal seams in accordance with Carpet Manufacturer's instructions and according to CRI Carpet Installation Standard (2009) as applicable. Seam carpet base only at inside corners.
    - b. No seam separation in carpet and no more observable seams from any standing position than that which is unavoidable using best seaming materials and practices available at time of installation.
    - c. Lay rooms parallel to respective Corridors. Seam to permit best use of available carpet.
    - d. Quarter turning allowed only at cross-Corridors longer than **24 feet (7.315 m)**.
    - e. Use single or double seams at doorways (single seams preferred). Run nap of pieced carpet in same direction.
- B. Carpet Base:
  1. Precut base so seams occur only at inside corners.
  2. Scribe base to floor.
  3. Spread adhesive over back side of base up to bottom of serging on edge or apply three **3/16 inch (4.76 mm)** minimum diameter beads of adhesive placed one inch apart on back of base with top bead placed **2 inch (50 mm)** down from serged edge of base and spread adhesive over back surface of base up to bottom edge of serging.
    - a. Bird's mouth finish should only be required when door frame is flush with wall.
    - b. If bird's mouth is required, terminate at door frames or vertical trim with 45 degree angle, bird mouth cut so serged edge turns down to contact frame or trim.
  4. Do not allow adhesive beyond edge of base. Remove excess adhesive.
  5. Do not use staples, nails, screws or other mechanical fasteners.
  6. Set carpet base on brick walls at height either above or below horizontal mortar joint line.

### 3.4 FIELD QUALITY CONTROL

- A. Field Inspections:
  1. Carpeting:
    - a. Unacceptable carpet after installation shall include but not be limited to:

- 1) Delaminating carpet from backings.
  - 2) Fiber loss less than specified.
  - 3) Edge raveling.
  - 4) Fuzzing of carpet fibers.
  - 5) Pilling of carpet fibers.
  - 6) Appearance retention less than control samples attached to Agreement.
  - 7) Dye bleeding.
  - 8) Zippering fibers in carpet.
  - 9) Color streaking.
  - 10) Irregular tufts of fiber.
- b. Unacceptable workmanship shall include but not be limited to:
- 1) Improper floor preparation before installation.
  - 2) Failure of adhesive to completely adhere carpet to floor resulting in bubbles, ridges, or ripples where carpet has separated from floor.
  - 3) Seams that do not comply with specified requirements:
    - a) Raveled or untrimmed seams.
    - b) Seams not sealed, level, straight, or even.
    - c) Open seams.
    - d) Seams visibly open when viewed by Project Manager from standing position.
  - 4) Sequence rolls, commercial match issues created by rolls being installed out of sequence will require correction or replacement.
  - 5) Failure to properly install carpet next to walls and door frames to eliminate gaps or puckering of carpet.
  - 6) Use of unspecified carpet.
  - 7) Carpet base ends not finished to terminate at door frames or vertical trim shall have 45 degree angle 'birdsmouth' finish.
  - 8) Adhesive exposed on carpet, on carpet base, beyond edges of carpet base, and on other surfaces of building.
  - 9) Carpet base that is not scribed to fit against floor with no gaps.
  - 10) Carpet base attached by means other than acceptable carpet base adhesive.
- B. Non-Conforming Work:
1. Carpeting:
    - a. Basis of Acceptable Carpeting: Source Quality Control Testing:
      - 1) Carpet products not meeting Design Criteria and Source Quality Control Testing of this specification will be considered unacceptable carpeting.
    - b. Unacceptable Carpeting:
      - 1) Unacceptable carpeting will be rejected and shall be repaired or replaced at no additional cost to Owner. Owner's Representative will determine reasonable location of acceptable transition points for removal of unacceptable carpet. Minimum replacement size shall be:
        - a) Between nearest existing seams.
        - b) Between natural transition points or **12 feet (3.6 meters)** of running length.

### 3.5 CLEANING

- A. General:
1. Carpet Installer's Responsibility:
    - a. Clean all exposed surfaces of adjoining areas of adhesive spatter before it sets.
    - b. Carpeting:
      - 1) Remove any soiling and/or staining from carpet.
      - 2) Remove excessive adhesive with manufacturer recommended adhesive removers.
- B. Damage to building:
1. Carpeting:
    - a. Carpet Installer's Responsibility:
      - 1) Clean and repair of all damaged surfaces to their original condition from carpet installation.

**C. Waste Management:****1. Carpet Installer's Responsibility:**

- a. All work areas are to be kept clean, clear and free of debris at all times.
- b. Provide adequate waste receptacles and dispose of materials including all rubbish, wrapping paper, scraps, and trimmings from building and property in approved manner as specified in Section 01 7400 unless pre-arrangements have been made with Owner and estimated costs are included on estimate and Purchase Order (PO).

**3.6 PROTECTION****A. Protection of Carpeting:****1. Owner Representative's Responsibility:**

- a. No traffic of any kind on newly installed carpet for minimum of twenty-four (24) hours after installation is completed.
- b. No wheeled traffic of any kind placement of furniture or equipment on carpet for minimum of forty-eight (48) hours after completion of carpet installation.
- c. Protect carpet from abuse, vandalism, or damage occurring after installation is complete.
- d. Protect carpet adequately from soil, dust, moisture and other contaminants after carpet installation.

**END OF SECTION**

**SECTION 09 9001**

**COMMON PAINTING AND COATING REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Common procedures and requirements for field-applied painting and coating.
- B. Related Requirements:
  - 1. Section 07 9213: 'Elastomeric Joint Sealants' for quality of Elastomeric Joint Sealants.
  - 2. Sections under 09 9000 heading 'Paints and Coatings'.
    - a. Pre-Installation conferences held jointly with Section 09 9001.
  - 3. Divisions 22 and 23: Painting of plumbing and HVAC identification, refrigerant line insulation, and duct interiors.

**1.2 REFERENCES**

- A. Definitions:
  - 1. Damage Caused By Others: Damage caused by individuals other than those under direct control of Painting Applicator (MPI(a), PDCA P1.92).
  - 2. Gloss Levels:
    - a. Specified paint gloss level shall be defined as sheen rating of applied paint, in accordance with following terms and values, unless specified otherwise for a specific paint system.

Gloss Level '1'	Traditional matte finish - flat	0 to 5 units at 60 degrees to 10 units maximum at 85 degrees.
Gloss Level '2'	High side sheen flat - 'velvet-like' finish	10 units maximum at 60 degrees and 10 to 35 units at 85 degrees.
Gloss Level '3'	Traditional 'eggshell-like' finish	10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.
Gloss Level '4'	'Satin-like' finish	20 to 35 units at 60 degrees and 35 units minimum at 85 degrees.
Gloss Level '5'	Traditional semi-gloss	35 to 70 units at 60 degrees.
Gloss Level '6'	Traditional gloss	70 to 85 units at 60 degrees.
Gloss Level '7'	High gloss	More than 85 units at 60 degrees.

- 3. Properly Painted Surface:
  - a. Surface that is uniform in appearance, color, and sheen and free of foreign material, lumps, skins, runs, sags, holidays, misses, strike-through, and insufficient coverage. Surface free of drips, spatters, spills, and overspray caused by Paint Applicator. Compliance will be determined when viewed without magnification at a distance of **5 feet (1.50 m)** minimum under normal lighting conditions and from normal viewing position (MPI(a), PDCA P1.92).
- 4. Latent Damage: Damage or conditions beyond control of Painting Applicator caused by conditions not apparent at time of initial painting or coating work.

- B. Reference Standards:
  - 1. The latest edition of the following reference standard shall govern all painting work:
    - a. MPI(a), 'Architectural Painting Specification Manual' by Master Painters Institute (MPI), as issued by local MPI Accredited Quality Assurance Association having jurisdiction.



- b. MPI(r), 'Maintenance Repainting Manual' by Master Painters Institute (MPI), as issued by local MPI Accredited Quality Assurance Association having jurisdiction.

### 1.3 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Conferences:
  1. Schedule painting pre-installation conference after delivery of paint or coatings and before or at same time as application of field samples.
    - a. Coordinate pre-installation conferences of all related painting and coating Sections under 09 9000 heading 'Paints and Coatings'.
    - b. Schedule conference before preparation of control samples as specified in Sections under 09 9000 heading 'Paints and Coatings'.
    - c. Conference to be held at same time as Section 09 2900 to review gypsum board finish preparation.
  2. In addition to agenda items specified in Section 01 3100, review following:
    - a. Review Quality Assurance for Approval requirements.
    - b. Review Quality Assurance Field Sample requirements.
    - c. Review Submittal requirements for compliance for MPI Approved Products.
    - d. Review Design Criteria requirements.
    - e. Review Cleaning requirements.
    - f. Review painting schedule.
    - g. Review safety issues.
  3. Review additional agenda items from Sections under 09 9000 heading 'Paints and Coatings'.

### 1.4 SUBMITTALS

- A. Action Submittals:
  1. Product Data:
    - a. Include following information for each painting product, arranged in same order as in Project Manual.
      - 1) Manufacturer's cut sheet for each product indicating ingredients and percentages by weight and by volume, environmental restrictions for application, and film thicknesses and spread rates.
      - 2) Provide one (1) copy of 'MPI Approved Products List' showing compliance for each MPI product specified.
        - a) MPI Information is available from MPI Approved Products List using the following link: <http://www.paintinfo.com/mpi/approved/index.shtml>.
      - 3) Confirmation of colors selected and that each area to be painted or coated has color selected for it.
- B. Informational Submittals:
  1. Manufacturer Instructions:
    - a. Manufacturer's substrate preparation instructions and application instruction for each painting system used on Project.
  2. Qualification Statement:
    - a. Applicator:
      - 1) Provide Qualification documentation if requested by Architect or Owner.
- C. Closeout Submittals:
  1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    - a. Record Documentation:
      - 1) Manufacturer's documentation:
        - a) Manufacturer's cut sheet for each component of each system.
        - b) Schedule showing rooms and surfaces where each system was used.
- D. Maintenance Materials Submittals:
  1. Extra Stock Materials:

- a. Provide painting materials in Manufacturer's original containers and with original labels in each color used. Label each can with color name, mixture instructions, date, and anticipated shelf life.
- b. Provide one (1) quart of each finish coat and one (1) pint of each primer and of each undercoat in each color used.

## 1.5 QUALITY ASSURANCE

- A. Regulatory Agency Sustainability Approval:
1. Conform to work place safety regulations and requirements of those authorities having jurisdiction for storage, mixing, application and disposal of all paint and related hazardous materials.
  2. Paint and painting materials shall be free of lead and mercury, and have VOC levels acceptable to local jurisdiction.
  3. Master Painters Institute (MPI) Standards:
    - a. Products: Comply with MPI standards indicated and listed in 'MPI Approved Products List'.
    - b. Preparation and Workmanship: Comply with requirements in 'MPI Architectural Painting Specification Manual' for products and coatings indicated.
- B. Qualifications:
1. Applicator: Requirements of Section 01 4301 applies, but not limited to following:
    - a. Minimum five (5) years' experience in painting installations.
    - b. Minimum five (5) satisfactorily completed projects of comparable quality, similar size, and complexity in past three (3) years before bidding.
    - c. Maintain qualified crew of painters throughout duration of the Work.
    - d. Upon request, submit documentation.
- C. Field Samples:
1. Before application of any paint system, meet on Project site with Architect, Owner's representative, and Manufacturer's representative. Architect may select one (1) surface for application of each paint system specified. This process will include establishing acceptable substrate conditions required for Project before application of paints and coatings.
  2. Apply paint systems to surfaces indicated by Architect following procedures outlined in Contract Documents and Product Data submission specified above.
  3. After approval of samples, proceed with application of paint system throughout Project. Approved samples will serve as standard of acceptability.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery And Acceptance Requirements:
1. Deliver specified products in sealed, original containers with Manufacturer's original labels intact on each container.
  2. Deliver amount of materials necessary to meet Project requirements in single shipment.
  3. Notify Architect two working days before delivery of coatings.
- B. Storage And Handling Requirements:
1. Store materials in single place.
  2. Keep storage area clean and rectify any damage to area at completion of work of this Section.
  3. Maintain storage area at 55 deg F (13 deg C) minimum.

## 1.7 FIELD CONDITIONS

- A. Ambient Conditions:
1. Perform painting operations at temperature and humidity conditions recommended by Manufacturer for each operation and for each product for both interior and exterior work.
  2. Apply painting systems at lighting level of 540 Lux (50 foot candles) minimum on surfaces to be painted.

- a. Inspection of painting work shall take place under same lighting conditions as application.
- b. If painting and coating work is applied under temporary lighting, deficiencies discovered upon installation of permanent lighting will be considered latent damage as defined in MPI Manual, PDCA P1-92.

## **PART 2 - PRODUCTS**

### **2.1 SYSTEMS**

#### **A. Performance:**

##### **1. Design Criteria:**

- a. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
- b. All materials, preparation and workmanship shall conform to requirements of 'Architectural Painting Specification Manual' by Master Painters Institute (MPI).
- c. All paint manufacturers and products used shall be as listed under Approved Product List section of MPI Painting Manual.
- d. Provide Premium Grade systems (2 top coats) as defined in MPI Architectural Painting Specification Manual, except as otherwise indicated.
- e. Where specified paint system does not have Premium Grade, provide Budget Grade.
- f. Provide products of same manufacturer for each coat in coating system.
- g. Where required to meet LEED (Leadership in Energy and Environmental Design) program requirements, use only MPI listed materials having an "L" rating designation.
- h. Color Levels:
  - 1) Color Level II:
    - a) Number and placement of interior and exterior paint colors and gloss levels shall be as defined by Color Level II from MPI Manual, PDCA P3-93 as modified in following paragraph.
    - b) No more than one paint color or gloss level will be selected for same substrate within designated interior rooms or exterior areas.

#### **B. Materials:**

1. Materials used for any painting system shall be from single manufacturer unless approved otherwise in writing by painting system manufacturers and by Architect. Include manufacturer approvals in Product Data submittal.
2. Linseed oil, shellac, turpentine, and other painting materials shall be pure, be compatible with other coating materials, bear identifying labels on containers, and be of highest quality of an approved manufacturer listed in MPI manuals. Tinting color shall be best grade of type recommended by Manufacturer of paint or stain used on Project.

## **PART 3 - EXECUTION**

### **3.1 APPLICATORS**

#### **A. Approved Applicators:**

1. Meet Quality Assurance Applicator Qualifications as specified in Part 1 of this specification.

### **3.2 EXAMINATION**

#### **A. Verification Of Conditions:**

1. Directing applicator to begin painting and coating work will indicate that substrates to receive painting and coating materials have been previously inspected as part of work of other Sections

and are complete and ready for application of painting and coating systems as specified in those Sections.

B. Pre-Installation Testing:

1. Before beginning work of this Section, examine, and test surfaces to be painted or coated for adhesion of painting and coating systems.
2. Report in writing to Architect of conditions that will adversely affect adhesion of painting and coating work.
3. Do not apply painting and coating systems until party responsible for adverse condition has corrected adverse condition.

C. Evaluation And Assessment:

1. Report defects in substrates that become apparent after application of primer or first finish coat to Architect in writing and do not proceed with further work on defective substrate until such defects are corrected by party responsible for defect.

### 3.3 PREPARATION

A. Protection Of In-Place Conditions:

1. Protect other finish work and adjacent materials during painting. Do not splatter, drip, or paint surfaces not intended to be painted. These items will not be spelled out in detail but pay special attention to the following:
  - a. Do not paint finish copper, bronze, chromium plate, nickel, stainless steel, anodized aluminum, or monel metal except as explicitly specified.
  - b. Keep cones of ceiling speakers completely free of paint. In all cases where painting of metal speaker grilles is required, paint without grilles mounted to speakers and without grilles on ceiling.
  - c. On existing work where ceiling is to be painted, speakers and grilles are already installed, and ceiling color is not being changed, mask off metal grilles installed on ceiling speakers. If ceiling color is being changed, remove metal grilles and paint, and mask off ceiling speakers.

B. Surface Preparation:

1. Prepare surfaces in accordance with MPI requirements and requirements of Manufacturer for each painting system specified, unless instructed differently in Contract Documents. Bring conflicts to attention of Architect in writing.
2. Fill minor holes and cracks in wood surfaces to receive paint or stain.
3. Surfaces to be painted shall be clean and free of loose dirt. Clean and dust surfaces before painting or finishing.
4. Do no exterior painting while surface is damp, unless recommended by Manufacturer, nor during rainy or frosty weather. Interior surfaces shall be dry before painting. Moisture content of materials to be painted shall be within tolerances acceptable to Paint Manufacturer.
5. Sand woodwork smooth in direction of grain leaving no sanding marks. Clean surfaces before proceeding with stain or first coat application.

### 3.4 APPLICATION

A. Interface With Other Work:

1. Coordinate with other trades for materials and systems that require painting before installation.
2. Schedule painting and coating work to begin when work upon which painting and coating work is dependent has been completed. Schedule installation of pre-finished and non-painted items, which are to be installed on painted surfaces, after application of final finishes.

B. Paint or finish complete all surfaces to be painted or coated as described in Contract Documents, including but not limited to following items.

1. Finish casework and wood trims that are specified to be installed under Section 06 2001 and that are not called out to be factory-or shop-finished. Back prime wood elements to be installed against concrete or masonry or that may be subjected to moisture.
  2. Paint mechanical, electrical, and audio/visual items that require field painting as indicated in Contract Documents. These include but are not limited to:
    - a. Gas pipe from gas meter into building.
    - b. Mechanical flues and pipes penetrating roof.
    - c. Electrical panel and disconnect enclosures.
    - d. Metal protective structures for refrigerant lines.
  3. Metal reveals at ceiling access doors.
  4. Paint inside of chases in occupied spaces flat black for 18 inches (450 mm) or beyond sightline, whichever is greater.
- C. Apply sealant in gaps 3/16 inch (5 mm) and smaller between two substrates that are both to be painted or coated. Sealants in other gaps furnished and installed under Section 07 9213.
- D. On wood to receive a transparent finish, putty nail holes in wood after application of stain using natural colored type to match wood stain color. Bring putty flush with adjoining surfaces.
- E. In multiple coat paint work, tint each succeeding coat with slightly lighter color, but approximating shade of final coat, so it is possible to check application of specified number of coats. Tint final coat to required color.
- F. Spread materials smoothly and evenly. Apply coats to not less than wet and dry film thicknesses and at spreading rates for specified products as recommended by Manufacturer.
- G. Touch up suction spots after application of first finish coat.
- H. Paint shall be thoroughly dry and surfaces clean before applying succeeding coats.
- I. Use fine sandpaper between coats as necessary to produce even, smooth surfaces.
- J. Make edges of paint adjoining other materials or colors clean, sharp, and without overlapping.
- K. Finished work shall be a 'Properly Painted Surface' as defined in this Section.

### 3.5 FIELD QUALITY CONTROL

- A. Non-Conforming Work:
1. Correct deficiencies in workmanship as required to leave surfaces in conformance with 'Properly Painted Surface,' as defined in this Section.
  2. Correction of 'Latent Damage' and 'Damage Caused By Others,' as defined in this Section, is not included in work of this Section.

### 3.6 CLEANING

- A. General:
1. As work proceeds and upon completion of work of any painting Section, remove paint spots from floors, walls, glass, or other surfaces and leave work clean, orderly, and in acceptable condition.
- B. Waste Management:
1. Remove rags and waste used in painting operations from building each night. Take every precaution to avoid danger of fire.
  2. Paint, stain and wood preservative finishes and related materials (thinners, solvents, caulking, empty paint cans, cleaning rags, etc.) shall be disposed of subject to regulations of applicable authorities having jurisdiction.
  3. Remove debris caused by work of paint Sections from premises and properly dispose.

4. Retain cleaning water and filter out and properly dispose of sediments.

**END OF SECTION**



**SECTION 09 9121****INTERIOR PAINTED POURED CONCRETE****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Preparing and painting of new concrete floors to be left exposed in finished building, as described in Contract Documents.
  - 2. Preparing and painting following existing concrete floors as described in Contract Documents:
    - a. Existing Mechanical Rooms.
- B. Related Requirements:
  - 1. Section 09 9001: 'Common Painting And Coating Requirements':
    - a. Pre-installation conference for Sections under 09 9000 heading 'Paints and Coatings'.
    - b. 'Attachment: Paint Color Schedule' for O&M / R&I Projects.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-Installation Conferences:
  - 1. Participate in pre-installation conference as specified in Section 09 9001.

**PART 2 - PRODUCTS****2.1 SYSTEM**

- A. Manufacturers:
  - 1. Category Four Approved Products and Manufacturers. See Section 01 6200 for definitions of Categories.
    - a. Products listed in edition of MPI Approved Product List current at time of bidding and later are approved, providing they meet VOC requirements in force where Project is located.
- B. Description:
  - 1. New Surfaces: Use MPI(a) INT 3.2A Latex Finish system
  - 2. Previously Finished Surfaces: Use MPI(r) RIN 3.2A Latex Finish system.
  - 3. Finish Requirements: Use MPI Custom Grade finish requirements.
- C. Performance:
  - 1. Design Criteria:
    - a. Gloss / Sheen Level Required: Semi-Gloss.
- D. Materials:
  - 1. MPI Product 60: 'Floor Paint, Latex, Low Gloss'.

**PART 3 - EXECUTION****3.1 APPLICATION**

- A. General: See appropriate paragraphs of Section 09 9001.



**B. Existing Painted Surfaces:**

1. Remove deteriorated existing paint down to sound substrate by scraping and sanding. Feather edges of existing paint by sanding to be smooth with adjacent surfaces. Acid etch bare concrete areas, if necessary.
2. Clean floors as recommended by Paint Manufacturer.
3. Apply coating system.

**END OF SECTION**

**SECTION 09 9122****INTERIOR PAINTED CMU****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Preparing and painting new interior CMU walls as described in Contract Documents.
  - 2. Preparing and painting existing interior CMU surfaces listed below as described in Contract Documents:
    - a. Mothers Room
    - b. Class Room 102.
    - c. Mechanical M102.
- B. Related Requirements:
  - 1. Section 09 9001: 'Common Painting And Coating Requirements':
    - a. Pre-installation conference for Sections under 09 9000 heading 'Paints and Coatings'.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-Installation Conferences:
  - 1. Participate in pre-installation conference as specified in Section 09 9001.
    - a. 'Attachment: Paint Color Schedule' for O&M / R&I Projects.

**PART 2 - PRODUCTS****2.1 SYSTEM**

- A. Manufacturer:
  - 1. Category Four Approved Products and Manufacturers. See Section 01 6200 for definitions of Categories:
    - a. Products listed in edition of MPI Approved Product List current at time of bidding and later are approved, providing they meet VOC requirements in force where Project is located.
- B. Description:
  - 1. Rest Rooms, Font Rooms, And Custodial Rooms:
    - a. New Surfaces: Use MPI(a) INT 4.2F Waterborne Epoxy Finish system.
    - b. Previously Finished Surfaces: Use MPI(r) RIN 4.2E Waterborne Epoxy Finish system.
  - 2. All Other:
    - a. New Surfaces: Use MPI(a) INT 4.2D Latex Finish system.
    - b. Previously Finished Surfaces: Use MPI(r) REX 4.2H Latex Finish system.
- C. Performance:
  - 1. Design Criteria:
    - a. New Surfaces: MPI Premium Grade finish requirements.
    - b. Deteriorated Existing Surfaces: MPI Premium Grade finish requirements.
    - c. Sound Existing Surfaces: MPI Custom Grade finish requirements.
    - d. Gloss / Sheen Level Required: Gloss Level 5.
- D. Materials:
  - 1. Block Filler, Over New Masonry Only: MPI Product 4: 'Block Filler, Latex, Interior/Exterior'.

2. Finish Coats: MPI Product 141: 'Latex, Interior, High Performance Architectural, Semi-Gloss (MPI Gloss Level 5)'.

## **PART 3 - EXECUTION**

### **3.1 APPLICATION**

- A. General: See appropriate paragraphs of Section 09 9001.
- B. Existing Painted Surfaces:
  1. Remove deteriorated existing paint by scraping or sanding. Wash surfaces that have been defaced with marking pens, crayons, lipstick, etc, with solvent recommended by Paint Manufacturer. Spot prime such surfaces.
  2. Sand areas of existing sound paint if necessary for bonding of new paint system. Clean existing painted surfaces, sanded or not, with mild soap and water, or with tri-sodium phosphate (TSP).
  3. Fill large holes with patching and small holes and cracks with spackle.
  4. Apply one coat primer to scraped and sanded areas.
  5. Apply one finish coat. Completely cover voids in masonry block but do not fill.

**END OF SECTION**

**SECTION 09 9125****INTERIOR PAINTED WOOD****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Preparing and painting new woodwork as described in Contract Documents.
  - 2. Preparing and painting following existing woodwork surfaces not requiring transparent finish, as described in Contract Documents:
    - a. Ceiling Trim
- B. Related Requirements:
  - 1. Section 09 9001: 'Common Painting And Coating Requirements':
    - a. Pre-installation conference for Sections under 09 9000 heading 'Paints and Coatings'.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-Installation Conferences:
  - 1. Participate in pre-installation conference as specified in Section 09 9001.

**PART 2 - PRODUCTS****2.1 SYSTEM**

- A. Manufacturers:
  - 1. Category Four Approved Products and Manufacturers. See Section 01 6200 for definitions of Categories:
    - a. Products listed in edition of MPI Approved Product List current at time of bidding and later are approved, providing they meet VOC requirements in force where Project is located.
- B. Description:
  - 1. Systems:
    - a. All Other:
      - 1) New Surfaces: Use MPI(a) INT 6.3T or U Latex Finish system.
      - 2) Previously Finished Surfaces: MPI(r) Rin 6.3U Latex Finish system.
- C. Performance:
  - 1. Design Criteria:
    - a. New Surfaces: MPI Premium Grade finish requirements.
    - b. Deteriorated Existing Surfaces: MPI Premium Grade finish requirements.
    - c. Sound Existing Surfaces: MPI Custom Grade finish requirements.
    - d. Gloss / Sheen Level Required: Gloss Level 5.
- D. Materials:
  - 1. Woodwork:
    - a. Primer Coat: MPI Product 39, 'Primer, Latex, for Interior Wood' or MPI Product 45, 'Primer Sealer, Alkyd, Interior'.
    - b. Finish Coats: MPI Product 153, 'Light Industrial Coating, Interior, Water Based, Semi-Gloss (MPI Gloss Level 5)'.

**PART 3 - EXECUTION****3.1 APPLICATION**

- A. General: See appropriate paragraphs of Section 09 9001.
- B. Interface With Other Work:
  - 1. Properly clean and paint light cove interiors before installation of light fixtures.
  - 2. Where back-priming is required, apply one (1) coat of primer.
- C. New Surfaces:
  - 1. Spot prime nail holes, cracks, and blemishes before and after puttying.
  - 2. Apply stain blocker or other product recommended by Paint Manufacturer to knots before applying primer coat.
- D. Existing Painted Surfaces:
  - 1. Remove deteriorated existing paint down to sound substrate by scraping and sanding. Feather edges of existing paint by sanding to be smooth with adjacent surfaces. Spot prime bare wood areas on woodwork.
  - 2. Wash surfaces that have been defaced with marking pens, crayons, lipstick, etc, with solvent recommended by Paint Manufacturer. Spot prime such surfaces.
  - 3. Apply finish coats.

**END OF SECTION**

**SECTION 09 9323****INTERIOR CLEAR-FINISHED SOFTWOOD****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Preparing and finishing interior clear finished softwood.
- B. Related Requirements:
  - 1. Section 09 9001: 'Common Painting And Coating Requirements':
    - a. Pre-installation conference for Sections under 09 9000 heading 'Paints and Coatings'.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-Installation Conferences:
  - 1. Participate in pre-installation conference as specified in Section 09 9001.

**PART 2 - PRODUCTS****2.1 SYSTEM**

- A. Manufacturers:
  - 1. Category Four Approved Products and Manufacturers. See Section 01 6200 for definitions of Categories:
    - a. Products listed in edition of MPI Approved Product List current at time of bidding and later are approved, providing they meet VOC requirements in force where Project is located.
- B. Description:
  - 1. System:
    - a. Use MPI(a) INT 6.3E Polyurethane Varnish Finish system for new work and MPI(r) RIN 6.3E Polyurethane Varnish Finish system for previously finished work.
- C. Performance:
  - 1. Design Criteria:
    - a. Use MPI Custom Grade requirements.
    - b. Gloss / Sheen Level Required: Gloss Level 4.
- D. Materials:
  - 1. Stain (If required): MPI Product 90, 'Stain, Semi-Transparent, for Interior Wood'.
  - 2. Finish Coats: MPI Product 57, 'Varnish, Interior, Polyurethane, Oil Modified, Satin'.

**PART 3 - EXECUTION****3.1 APPLICATION**

- A. General: See appropriate paragraphs of Section 09 9001.
- B. New Work:

1. Apply seal coat of one part shellac and seven parts denatured alcohol as follows:
  - a. Before applying products specified above.
  - b. As back-priming, where required.
  
- C. Existing Work:
  1. Sand with fine sandpaper to remove scratches or blemishes.
  2. Clean surfaces with thinner or turpentine.
  3. Prime surfaces with a blocker that will permit Urethane finishes to be applied over lacquer or varnish, or remove previous finishes with paint remover.
  4. Clean surface with soft cloth dampened with thinner.
  5. Stain as specified for new work, if previous coats were removed.
  6. Apply two coats of urethane.

**END OF SECTION**

**SECTION 09 9413****INTERIOR TEXTURED FINISHING****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and apply texturing on walls and ceilings as described in Contract Documents.
- B. Related Requirements:
  - 1. Section 09 2900: 'Gypsum Board' for priming.
  - 2. Section 09 9001: 'Common Painting And Coating Requirements' for:
    - a. Pre-installation conference for Sections under 09 9000 heading 'Paints and Coatings'.

**1.2 REFERENCES**

- A. Definitions:
  - 1. Drywall Texture: Compound rolled, sprayed, or troweled onto sheetrock after taping and floating of joints is complete. Uses same material as joint compound, but thinned down with water and applied to wall surface:
    - a. Light Orange Peel: Sprayed texture leaves light splatter on walls. Resembles peel of orange. If done with fine spray, can be one of the lightest, least noticeable of the texture styles.
    - b. Light Skip Trowel - Texture is applied to ceilings with trowel. Trowel marks may be left on surface to give a rustic, hand crafted look.
    - c. Smooth - Smooth application of texture over sheetrock wall that feathers out sheetrock joints, and creates even, non-textured wall.

**1.3 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-Installation Conferences:
  - 1. Participate in pre-installation conference as specified in Section 09 9001.
  - 2. In addition to agenda items specified in Section 01 3100 and Section 09 9001, review following:
    - a. Review control samples.

**1.4 SUBMITTALS**

- A. Action Submittals:
  - 1. Samples:
    - a. Light Orange Peel Texture:
      - 1) Provide minimum of three (3) 24 inch (600 mm) square control samples on primed gypsum wallboard of 'light orange peel' texture to show possible variations.
    - b. Light Skip Trowel Texture:
      - 1) Provide minimum of three (3) 24 inch (600 mm) square control samples on primed gypsum wallboard of 'light orange peel' texture to show possible variations.

**1.5 QUALITY ASSURANCE**

- A. Field Samples:
  - 1. Before performing work of this Section, prepare control samples.



2. Architect will inspect control sample at pre-installation conference following preparation of control sample. When sample is approved, work of this Section may proceed. Approved samples will be kept at site at all times work of this section is being performed.

## **PART 2 - PRODUCTS**

### **2.1 SYSTEM**

- A. Manufacturers:
  1. Manufacturer Contact List:
    - a. National Gypsum, Charlotte, NC [www.nationalgypsum.com](http://www.nationalgypsum.com).
    - b. U S Gypsum Co, Chicago, IL [www.usg.com](http://www.usg.com).
- B. Materials:
  1. Class Two Quality Standards: See Section 01 6200.
    - a. ProForm Perfect Spray EM/HF by National Gypsum.
    - b. Sheetrock Wall & Ceiling Texture by U S Gypsum.

## **PART 3 - EXECUTION**

### **3.1 APPLICATION**

- A. Location:
  1. Walls:
    - a. Light Orange Peel Texture:
      - 1) All areas except those listed in following paragraph.
    - b. Smooth:
      - 1) Restrooms. Mechanical Rooms, Storage Rooms, and other Utility Areas.
  2. Ceilings:
    - a. Light Orange Peel Texture:
      - 1) Bishop's Waiting Areas and corridor transition into Foyers (sides and bottoms of headers).
      - 2) High Council Rooms Areas where there is exposed gypsum board (includes soffit and fascia of coffered area at perimeter).
      - 3) Relief Society and Primary Rooms Areas where there is exposed gypsum board (includes soffit and fascia of coffered area at perimeter).
    - b. Light Skip Trowel Texture:
      - 1) Foyers (including soffits and fascias of light cove).
      - 2) Vestibules.
      - 3) All other locations not indicated elsewhere.
    - c. Smooth Finish (no applied texture) to be applied to the following ceilings:
      - 1) Mechanical Rooms, Storage Rooms, and other Utility Areas.
      - 2) Restrooms.
      - 3) Serving Area.
- B. Finishing:
  1. Light Orange Peel Texture:
    - a. After gypsum board is taped and sanded, apply texture. Closely match samples accepted by Architect.
      - 1) After wall has been textured, apply priming and finish paint as specified in Section 09 9123.
  2. Skip Trowel Texture:
    - a. After gypsum board is taped and sanded, apply texture. Closely match samples accepted by Architect.
      - 1) After wall has been textured, apply priming and paint as specified in Section 09 9123.

3. Smooth:
  - a. No applied texture is required. Apply priming and paint as specified in Section 09 9001.

**END OF SECTION**



**DIVISION 10: SPECIALTIES**

**10 1000 INFORMATION SPECIALTIES**

10 1495 MISCELLANEOUS INTERIOR SIGNAGE

10 1495 MISCELLANEOUS INTERIOR SIGNAGE

END OF TABLE OF CONTENTS



**SECTION 10 1495**  
**MISCELLANEOUS INTERIOR SIGNAGE**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Includes But Not Limited To:
1. Furnish and install interior signs as described in Contract Documents.

**1.2 SUBMITTALS**

- A. Action Submittals:
1. Shop Drawings: Schedule showing signs required, location, and text.
  2. Samples: Provide sample sign for comparison with existing signs.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURED UNITS**

- A. Signs:
1. Type Two Acceptable Products:
    - a. Provide required signs matching existing in color, lettering style, size, etc, as approved by Architect before installation. See Section 01 6200.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install signs square and plumb. Match mounting method and location of existing signs.

**END OF SECTION**



**DIVISION 22: PLUMBING**

**22 0000 PLUMBING**

- 22 0501 COMMON PLUMBING REQUIREMENTS
- 22 0529 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

**22 1000 PLUMBING PIPES AND PUMPS**

- 22 1313 FACILITY SANITARY SEWERS
- 22 1319 FACILITY SANITARY SEWER SPECIALTIES

**END OF TABLE OF CONTENTS**



**SECTION 22 0501****COMMON PLUMBING REQUIREMENTS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Common requirements and procedures for plumbing systems.
  - 2. Responsibility for proper operation of electrically powered equipment furnished under this Division.
  - 3. Furnish and install sealants relating to installation of systems installed under this Division.
  - 4. Furnish and install Firestop Penetration Systems for plumbing systems penetrations as described in Contract Documents.
- B. Products Furnished But Not Installed Under This Section:
  - 1. Sleeves, inserts, supports, and equipment for plumbing systems installed under other Sections.

**1.2 SUBMITTALS**

- A. Action Submittals:
  - 1. Product Data:
    - a. Manufacturer's catalog data for each manufactured item.
      - 1) Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
      - 2) Include name, address, and phone number of each supplier.
- B. Informational Submittals:
  - 1. Qualification Statement:
    - a. Plumbing Subcontractor:
      - 1) Provide Qualification documentation if requested by Architect or Owner.
    - b. Installer:
      - 1) Provide Qualification documentation if requested by Architect or Owner.
- C. Closeout Submittals:
  - 1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    - a. Operations and Maintenance Data (Modify and add to requirements of Section 01 7800):
      - 1) At beginning of PLUMBING section of Operations And Maintenance Manual, provide master index showing items included:
        - a) Provide name, address, and phone number of Architect, Architect's Mechanical Engineer, General Contractor, and Plumbing subcontractor.
        - b) Identify maintenance instructions by using same equipment identification used in Contract Drawings. Maintenance instructions shall include:
          - (1) List of plumbing equipment used indicating name, model, serial number, and nameplate data of each item together with number and name associated with each system item.
          - (2) Manufacturer's maintenance instructions for each piece of plumbing equipment installed in Project. Instructions shall include name of vendor, installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance instructions.
      - c) Provide operating instructions to include:
        - (1) General description of fire protection system.
        - (2) Step by step procedure to follow for shutting down system or putting system into operation.

- b. Warranty Documentation:
  - 1) Include copies of warranties required in individual Sections of Division 22.

### 1.3 QUALITY ASSURANCE

- A. Regulatory Agency Sustainability Approvals:
  - 1. Perform work in accordance with applicable provisions of Plumbing Codes applicable to Project. Provide materials and labor necessary to comply with rules, regulations, and ordinances.
  - 2. In case of differences between building codes, laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Notify Architect in writing of such differences before performing work affected by such differences.
  - 3. Identification:
    - a. Motor and equipment name plates as well as applicable UL / ULC and AGA / CGA labels shall be in place when Project is turned over to Owner.
- B. Qualifications. Requirements of Section 01 4301 applies, but not limited to following:
  - 1. Plumbing Subcontractor:
    - a. Company specializing in performing work of this section.
      - 1) Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
    - b. Upon request, submit documentation.
  - 2. Installer:
    - a. Licensed for area of Project.
    - b. Designate one (1) individual as project foremen who shall be on site at all times during installation and experienced with installation procedures required for this project.
    - c. Upon request, submit documentation.

### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Delivery And Acceptance Requirements:
  - 1. Accept valves on site in shipping containers with labeling in place.
  - 2. Provide temporary protective coating on cast iron and steel valves.
  - 3. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- B. Storage And Handling Requirements:
  - 1. In addition to requirements specified in Division 01, stored material shall be readily accessible for inspection by Architect until installed.
  - 2. Store items subject to moisture damage in dry, heated spaces.

### 1.5 WARRANTY

- A. Manufacturer Warranty:
  - 1. Provide certificates of warranty for each piece of equipment made out in favor of Owner.
- B. Special Warranty:
  - 1. Guarantee plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.
  - 2. If plumbing sub-contractor with offices located more than 150 miles from Project site is used, provide service / warranty work agreement for warranty period with local plumbing sub-contractor approved by Architect. Include copy of service / warranty agreement in warranty section of Operation And Maintenance Manual.

## **PART 2 - PRODUCTS**

### **2.1 COMPONENTS**

- A. Components shall bear Manufacturer's name and trade name. Equipment and materials of same general type shall be of same make throughout work to provide uniform appearance, operation, and maintenance.
- B. Sleeves:
  - 1. General:
    - a. Two sizes larger than bare pipe or insulation on insulated pipe.
  - 2. In Concrete And Masonry:
    - a. Sleeves through outside walls, interior shear walls, and footings shall be schedule 80 black steel pipe with welded plate.
  - 3. In Framing And Suspended Floor Slabs:
    - a. Standard weight galvanized iron pipe, Schedule 40 PVC, or 14 ga galvanized sheet metal.

## **PART 3 - EXECUTION**

### **3.1 INSTALLERS**

- A. Acceptable Installers:
  - 1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

### **3.2 EXAMINATION**

- A. Drawings:
  - 1. Plumbing Drawings show general arrangement of piping, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
  - 2. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Plumbing Drawings.
  - 3. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.
- B. Verification Of Conditions:
  - 1. Examine premises to understand conditions that may affect performance of work of this Division before submitting proposals for this work. Examine adjoining work on which plumbing work is dependent for efficiency and report work that requires correction.
  - 2. Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.
  - 3. Check that slots and openings provided under other Divisions through floors, walls, ceilings, and roofs are properly located. Perform cutting and patching caused by neglecting to coordinate with Divisions providing slots and openings at no additional cost to Owner.
  - 4. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

### **3.3 PREPARATION**

- A. Changes Due To Equipment Selection:
  - 1. Where equipment specified or otherwise approved requires different arrangement or connections from that shown in Contract Documents, submit drawings showing proposed installations.

2. If proposed changes are approved, install equipment to operate properly and in harmony with intent of Contract Documents. Make incidental changes in piping, ductwork, supports, installation, wiring, heaters, panelboards, and as otherwise necessary.
3. Provide additional motors, valves, controllers, fittings, and other equipment required for proper operation of systems resulting from selection of equipment.
4. Be responsible for proper location of rough-in and connections provided under other Divisions.

### 3.4 INSTALLATION

- A. Interface With Other Work:
  1. Furnish exact location of electrical connections and complete information on motor controls to installer of electrical system.
  2. Furnish sleeves, inserts, supports, and equipment that are to be installed by others in sufficient time to be incorporated into construction as work proceeds. Locate these items and confirm that they are properly installed.
- B. Cut carefully to minimize necessity for repairs to previously installed or existing work. Do not cut beams, columns, or trusses.
- C. Locating Equipment:
  1. Arrange pipes and equipment to permit ready access to valves, cocks, unions, traps, and to clear openings of doors and access panels.
  2. Adjust locations of pipes, equipment, and fixtures to accommodate work to interferences anticipated and encountered.
  3. Install plumbing work to permit removal of equipment and parts of equipment requiring periodic replacement or maintenance without damage to or interference with other parts of equipment or structure.
  4. Determine exact route and location of each pipe before fabrication.
    - a. Right-Of-Way:
      - 1) Lines that pitch shall have right-of-way over those that do not pitch. For example, plumbing drains shall normally have right-of-way.
      - 2) Lines whose elevations cannot be changed shall have right-of-way over lines whose elevations can be changed.
    - b. Offsets, Transitions, and Changes in Direction:
      - 1) Make offsets, transitions, and changes in direction in pipes as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.
      - 2) Furnish and install all traps, air vents, sanitary vents, and devices as required to effect these offsets, transitions, and changes in direction.
- D. Penetration Firestops:
  1. Install Penetration Firestop System appropriate for penetration at plumbing systems penetrations through walls, ceilings, roofs, and top plates of walls.
- E. Sealants:
  1. Seal openings through building exterior caused by penetrations of elements of plumbing systems.
  2. Furnish and install acoustical sealant to seal penetrations through acoustically insulated walls and ceilings.
- F. Furnish and install complete system of piping, valved as indicated or as necessary to completely control entire apparatus:
  1. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper installation of plumbing systems.
  2. Arrange piping to not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings:
    - a. Arrange so as to facilitate removal of tube bundles.
    - b. Provide accessible flanges or ground joint unions, as applicable for type of piping specified, at connections to equipment and on bypasses.

- 1) Make connections of dissimilar metals with di-electric unions.
  - 2) Install valves and unions ahead of traps and strainers. Provide unions on both sides of traps.
  - c. Do not use reducing bushings, bull head tees, close nipples, or running couplings. Street elbows are allowed only on potable water pipe 3/4 inch in diameter and smaller.
  - d. Install piping systems so they may be easily drained
  - e. Install piping to insure noiseless circulation.
  - f. Place valves and specialties to permit easy operation and access. Valves shall be regulated, packed, and glands adjusted at completion of work before final acceptance.
  3. Do not install piping in shear walls.
  4. Cut piping accurately to measurements established at site. Remove burr and cutting slag from pipes.
  5. Work piping into place without springing or forcing. Make piping connections to pumps and other equipment without strain at piping connection. Remove bolts in flanged connections or disconnect piping to demonstrate that piping has been so connected, if requested.
  6. Make changes in direction with proper fittings.
  7. Expansion of Thermoplastic Pipe:
    - a. Provide for expansion in every 30 feet of straight run.
    - b. Provide 12 inch offset below roof line in each vent line penetrating roof.
- G. Sleeves:
1. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete slabs on grade.
  2. Provide sleeves around pipes passing through concrete or masonry floors, walls, partitions, or structural members. Seal sleeves with specified sealants.
  3. Sleeves through floors shall extend 1/4 inch above floor finish in mechanical equipment rooms above basement floor. In other rooms, sleeves shall be flush with floor.
  4. Sleeves through floors and foundation walls shall be watertight.
- H. Escutcheons:
1. Provide spring clamp plates where pipes run through walls, floors, or ceilings and are exposed in finished locations of building. Plates shall be chrome plated heavy brass of plain pattern and shall be set tight on pipe and to building surface.

### 3.5 REPAIR / RESTORATION

- A. Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it:
1. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown.
  2. Surface finishes shall exactly match existing finishes of same materials.

### 3.6 FIELD QUALITY CONTROL

- A. Field Tests:
1. Perform tests on plumbing piping systems. Furnish devices required for testing purposes.
- B. Non-Conforming Work:
1. Replace material or workmanship proven defective with sound material at no additional cost to Owner.
  2. Repeat tests on new material, if requested.

### 3.7 CLEANING

- A. Remove dirt, grease, and other foreign matter from each length of piping before installation:
1. After each section of piping used for movement of water or steam is installed, flush with clean water, except where specified otherwise.
  2. Arrange temporary flushing connections for each section of piping and arrange for flushing total piping system.

3. Provide temporary cross connections and water supply for flushing and drainage and remove after completion of work.

B. Clean exposed piping, equipment, and fixtures. Remove stickers from fixtures and adjust flush valves.

### **3.8 CLOSEOUT ACTIVITIES**

A. Instruction of Owner:

1. Instruct building maintenance personnel and Stake Physical Facilities Representative in operation and maintenance of plumbing systems utilizing Operation And Maintenance Manual when so doing.
2. Conduct instruction period after Substantial Completion inspection when systems are properly working and before final payment is made.

### **3.9 PROTECTION**

A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system. Cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of system. Do not use plugs of rags, wool, cotton waste, or similar materials.

**END OF SECTION**

**SECTION 22 0529****HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Common hanger and support requirements and procedures for plumbing systems.
- B. Products Installed But Not Furnished Under This Section:
  - 1. Paint identification for gas piping used in HVAC equipment.
- C. Related Requirements:
  - 1. Section 05 0523: 'Metal Fastening' for quality and requirements for welding.
  - 2. Section 07 8400: 'Firestopping' for quality of Penetration Firestop Systems to be used on Project and submittal requirements.
  - 3. Sections Under 09 9000 Heading: Painting of mechanical items requiring field painting.
  - 4. Slots and openings through floors, walls, ceilings, and roofs provided under other Divisions in their respective materials.
  - 5. Section 23 0529: 'Hangers And Supports For HVAC Piping And Equipment' for gas piping used with HVAC equipment.
  - 6. Section 23 0553: 'Identification For HVAC Piping And Equipment' for paint identification of gas piping used with HVAC equipment.

**1.2 SUBMITTALS**

- A. Action Submittals:
  - 1. Product Data:
    - a. Manufacturer's catalog data for each manufactured item.

**PART 2 - PRODUCTS****2.1 ASSEMBLIES**

- A. Manufacturers:
  - 1. Manufacturer Contact List:
    - a. Anvil International, Portsmouth, NH [www.anvilintl.com](http://www.anvilintl.com).
    - b. Cooper B-Line, Highland, IL [www.b-line.com](http://www.b-line.com).
    - c. Unistrut, Wayne, MI [www.tyco-unistrut.com](http://www.tyco-unistrut.com).
- B. Materials:
  - 1. Hangers, Rods, And Inserts
    - a. Galvanized and UL approved for service intended.
    - b. Support horizontal piping from hangers or on roller assemblies with channel supports, except where trapeze type hangers are explicitly shown on Drawings. Hangers shall have double nuts.
      - 1) Support insulated pipes 2 inches in diameter and smaller with adjustable swivel ring hanger with insulation protection shield. Gauge and length of shield shall be in accordance with Anvil design data.
        - a) Type Two Acceptable Products:
          - (1) Swivel Ring Hanger: Anvil Fig. 69.
          - (2) Insulation Protection Shield: Anvil Fig. 167.
          - (3) Equals by Cooper B-Line.
      - 2) Support insulated pipes 2-1/2 inches in diameter and larger with clevis hanger or roller assembly with an insulation protection shield. Gauge and length of shield shall be according to Anvil design data.

- a) Type Two Acceptable Products:
  - (1) Clevis Hanger: Anvil Fig. 260.
  - (2) Roller Assembly: Anvil Fig. 171.
  - (3) Insulation Protection Shield: Anvil Fig. 167.
  - (4) Equals by Cooper B-Line.
- 3) Support uninsulated copper pipe 2 inches in diameter and smaller from swivel ring hanger, copper plated and otherwise fully suitable for use with copper tubing. Support non-copper uninsulated pipes from swivel ring hanger.
  - a) Type Two Acceptable Products:
    - (1) Swivel Ring Hanger For Copper Pipe: Anvil Fig. CT-69.
    - (2) Swivel Ring Hanger For Other Pipe: Anvil Fig. 69.
    - (3) Equals by Cooper B-Line.
- 4) Support uninsulated copper pipe 2-1/2 inches in diameter and larger from clevis hanger, copper plated hangers and otherwise fully suitable for use with copper tubing. Support non-copper uninsulated pipes from clevis hanger.
  - a) Type Two Acceptable Products:
    - (1) Clevis Hanger For Copper Pipe: Anvil Fig. CT-65.
    - (2) Clevis Hanger For Other Pipe: Anvil Fig. 260.
    - (3) Equals by Cooper B-Line.
- c. Support rods for single pipe shall be in accordance with following table:

Rod Diameter	Pipe Size
3/8 inch	2 inches and smaller
1/2 inch	2-1/2 to 3-1/2 inches
5/8 inch	4 to 5 inches
3/4 inch	6 inches
7/8 inch	8 to 12 inches

- d. Support rods for multiple pipe supported on steel angle trapeze hangers shall be in accordance with following table:

Rods		Number of Pipes per Hanger for Each Pipe Size						
Number	Diameter	2 Inch	2.5 Inch	3 Inch	4 Inch	5 Inch	6 Inch	8 Inch
2	3/8 Inch	Two	0	0	0	0	0	0
2	1/2 Inch	Three	Three	Two	0	0	0	0
2	5/8 Inch	Six	Four	Three	Two	0	0	0
2	5/8 Inch	Nine	Seven	Five	Three	Two	Two	0
2	5/8 Inch	Twelve	Nine	Seven	Five	Three	Two	Two

- 1) Size trapeze angles so bending stress is less than 10,000 psi.
- e. Riser Clamps For Vertical Piping:
  - 1) Type Two Acceptable Products:
    - a) Anvil Fig. 261.
    - b) Equals by Cooper B-Line.
- f. Concrete Inserts:
  - 1) Individual Inserts:
    - a) Suitable for special nuts size 3/8 inch through 7/8 inch with yoke to receive concrete reinforcing rods, and with malleable iron lugs for attaching to forms.
    - b) Type Two Acceptable Products:
      - (1) Anvil Fig. 282.
      - (2) Equals by Cooper B-Line.
  - 2) Continuous Inserts:
    - a) Class Two Quality Standard: Equal to Unistrut P-3200 series.
- g. Steel Deck Bracket:
  - 1) Class Two Quality Standard: Equal to Unistrut P1000 with clamp nut, minimum 6 inch length.



**PART 3 - EXECUTION****3.1 INSTALLATION****A. Piping:**

1. Properly support piping and make adequate provisions for expansion, contraction, slope, and anchorage.
  - a. Except for underground pipe, suspend piping from roof trusses or clamp to vertical walls using Unistrut and clamps. Do not hang pipe from other pipe, equipment, or ductwork. Laying of piping on any building element is not allowed.
  - b. Supports For Horizontal Piping:
    - 1) Support metal piping at 96 inches on center maximum for pipe 1-1/4 inches or larger and 72 inches on center maximum for pipe 1-1/8 inch or less.
    - 2) Support thermoplastic pipe at 48 inches on center maximum.
    - 3) Provide support at each elbow. Install additional support as required.
  - c. Supports for Vertical Piping:
    - 1) Place riser clamps at each floor or ceiling level.
    - 2) Securely support clamps by structural members, which in turn are supported directly from building structure.
    - 3) Provide clamps as necessary to brace pipe to wall.
  - d. Insulate hangers for copper pipe from piping by means of at least two layers of Scotch 33 plastic tape.
2. Gas piping Identification:
  - a. Apply paint identification for gas piping used with HVAC equipment as specified in Section 23 0553.

**END OF SECTION**

**SECTION 22 1313****FACILITY SANITARY SEWERS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install soil, waste, and vent piping systems within building and connect with outside utility lines 5 feet out from building as described in contract documents.
  - 2. Perform excavation and backfill required by work of this Section.
- B. Related Requirements:
  - 1. Section 07 8400: 'Firestopping' for quality of firestopping material.
  - 2. Section 22 0501: 'Common Plumbing Requirements'.
  - 3. Section 22 1319: 'Facility Sanitary Sewer Specialties' for furnishing of sewer specialties.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-Installation Conference: Participate in pre-installation conference specified in Section 03 3111.

**1.3 REFERENCES**

- A. Reference Standards:
  - 1. American National Standards Institute / American Water Works Association:
    - a. ANSI/AWWA C110/A21.10-12, 'Ductile-Iron and Gray-Iron Fittings'.
    - b. ANSI/AWWA C111/A21.11-17, 'Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings'.
    - c. ANSI/AWWA C115/A21.15-11, 'Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges'.
    - d. ANSI/AWWA C116/A21.16-15, 'Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service'.
    - e. ANSI/AWWA C150/A21.50-14, 'Thickness Design of Ductile-Iron Pipe'.
    - f. ANSI/AWWA C151/A21.51-17, 'Ductile-Iron Pipe, Centrifugally Cast, for Water'.
    - g. ANSI/AWWA C153/A21.53-11, 'Ductile-Iron Compact Fittings for Water Service'.
  - 2. American Water Works Association (AWWA):
    - a. AWWA M41, 'Ductile-Iron Pipe and Fittings' (3<sup>rd</sup> Edition).
  - 3. ASTM International:
    - a. ASTM A74-17, 'Standard Specification for Cast Iron Soil Pipe and Fittings'.
    - b. ASTM A888-18a, 'Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications'.
    - c. ASTM C564-14, 'Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings'.
  - 4. Cast Iron Soil Pipe Institute:
    - a. CISPI Standard 301-09, 'Standard Specification for Hubless Cast Iron Soil Pipe End Fittings for Sanitary & Storm Drain, Waste, and Vent Piping Applications'.
    - b. CISPI 310-11, 'Standard Specification for Couplings for use in connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications'.
    - c. CISPI Handbook. 'Cast Iron Soil Pipe and Fittings Handbook' (2006).
  - 5. International Code Council:
    - a. ICC IPC-2018, 'International Plumbing code'.

**PART 2 - PRODUCTS****2.1 SYSTEMS****A. Manufacturers:****1. Manufacturer Contact List:**

- a. American Brass & Iron (AB&I), Oakland, CA [www.abifoundry.com](http://www.abifoundry.com).
- b. Clamp-All Corp, Haverhill, MA [www.clampall.com](http://www.clampall.com).
- c. Anaco-Husky, Corona, CA [www.anaco-husky.com](http://www.anaco-husky.com).
- d. Josam Co, Michigan City, IN [www.josam.com](http://www.josam.com).
- e. Jay R. Smith Manufacturing Co, Montgomery, AL [www.jrsmith.com](http://www.jrsmith.com).
- f. MG Piping Products Co, Stanton, CA [www.mgcoupling.com](http://www.mgcoupling.com).
- g. Mifab Manufacturing Inc, Chicago, IL [www.mifab.com](http://www.mifab.com).
- h. Mission Rubber Co., Corona, CA [www.missionrubber.com](http://www.missionrubber.com).
- i. Wade Div Tyler Pipe, Tyler, TX [www.wadedrains.com](http://www.wadedrains.com).
- j. Watts Drainage, Spindale, NC [www.watts.com](http://www.watts.com) or Watts Industries, Burlington, ON, Canada [www.wattscda.com](http://www.wattscda.com).
- k. Zurn Cast Metals, Erie, PA or Zurn Industries Limited, Mississauga, ON [www.zurn.com](http://www.zurn.com).

**B. Performance:****1. Design Criteria:**

- a. Minimum size of waste piping installed under floor slab on grade shall be 2 inches.

**C. Materials:****1. Buried Piping:**

- a. Approved Types: Service weight, single-hub or no-hub type cast iron soil pipe meeting requirements of ASTM A74.
- b. Joint Material:
  - 1) Single-Hub: Rubber gaskets meeting requirements of ASTM C564.
  - 2) No-Hub:
    - a) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - b) American Brass & Iron: SuperGrip 304.
    - c) Anaco-Husky: Husky SD 4000 coupling.
    - d) Clamp-All: Neoprene gaskets with type 304 stainless steel clamp and 24 ga type 304 stainless steel housing.
    - e) Mission Rubber: Heavy weight coupling.
    - f) MG Piping: MB Coupling.
    - g) Mifab: MI-XHUB – Heavy duty shielded coupling type 301 or 304 stainless steel.

**2. Above Grade Piping, Piping in Tunnels and Vent Lines:**

- a. Approved Types:
  - 1) Service Weights, single-hub or no-hub type cast iron soil pipe meeting requirements of ASTM A74.
  - 2) Vent lines 2-1/2 inches or smaller may be Schedule 40 galvanized steel.
- b. Joint Material:
  - 1) Single-Hub: Rubber gaskets meeting requirements of ASTM C564.
  - 2) No-Hub Pipe: Neoprene gaskets with stainless steel cinch bands.

**3. Fittings:**

- a. Cast Iron Pipe: Hub and spigot, except fittings for no-hub pipe shall be no-hub, and meet requirements of ASTM A74.
  - 1) Joint Material: Rubber gaskets meeting requirements of ASTM C564.
  - 2) Galvanized Pipe: Screwed Durham tarred drainage type
- b. Traps installed on cast iron bell and spigot pipe shall be service weight cast iron. Traps installed on threaded pipe shall be recess drainage pattern type.
- c. P-Traps:
  - 1) Trap shall have clean out plug if installed in other than slab on grade.
  - 2) Type Two Acceptable Products.
    - a) JR Smith: 7220 deep seal cast iron.
    - b) Mifab: MI-950.
    - c) Zurn: Zurn Z-1000

- d) Equal as approved by Architect before installation. See Section 01 6200.
- 4. Cleanouts:
  - a. Furnish wall cleanouts with chrome wall cover and screw.
  - b. Type Two Acceptable Products:
    - 1) Finish Floors:
      - a) Josam: 56010.
      - b) J. R. Smith: 4023.
      - c) Mifab: C1100C-R-1.
      - d) Wade: W-6000.
      - e) Watts: CO-200-R.
      - f) Zurn: Z-1402.
    - 2) Resilient Flooring:
      - a) Josam: 56010-12.
      - b) J. R. Smith: 4140.
      - c) Mifab: C1100C-T-1.
      - d) Wade: W-6000-T.
      - e) Watts: CO-200-T.
      - f) Zurn: Z-1400.
    - 3) Finished Wall:
      - a) Josam: 58790.
      - b) J. R. Smith: 4530.
      - c) Mifab: C1460RD.
      - d) Wade: W8560E.
      - e) Watts: CO-460-RD.
      - f) Zurn: Z-1446.
    - 4) Exposed Drain Lines:
      - a) Josam: 58910.
      - b) J. R. Smith: 4510.
      - c) Mifab: C1460.
      - d) Wade: W8560B.
      - e) Watts: CO-460.
      - f) Zurn: Z-1440.
    - 5) General Purpose:
      - a) Josam: 58900.
      - b) J. R. Smith: 4400.
      - c) Mifab: C1300-MF
      - d) Wade: W8550E.
      - e) Watts: CO-380.
      - f) Zurn: Z-1440.
    - 6) Equal as approved by Architect before installation. See Section 01 6200.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Excavate and backfill as specified in Sections 31 2316 and 31 2323 with following additional requirements:
  - 1. Runs shall be as close as possible to those shown on Drawings.
  - 2. Excavate to required depth and grade to obtain fall required. Grade soil and waste lines within building perimeter 1/4 inch fall in one foot in direction of flow.
  - 3. Bottom of trenches shall be hard. Tamp as required.
  - 4. Remove debris from trench before laying of pipe.
  - 5. Do not cut trenches near footings without consulting Architect.
- B. Metal Pipe And Fittings:
  - 1. Provide depression under bell of each joint to maintain even bearing of sewer pipe.
  - 2. Connect to street main as required by local authorities.
  - 3. Use jacks to make-up gasketed joints.
  - 4. Do no caulk threaded work.

5. Use torque wrench to obtain proper tension in cinch bands when using hubless cast iron pipe. Butt ends of pipe against centering flange of coupling.
- C. Install piping so cleanouts may be installed as follows:
1. Where shown on Drawings and near bottom of each stack and riser.
  2. At each change of direction of the building drain or horizontal waste or soil lines greater than 45°. Where more than one 45° change of direction occurs in a run of piping, only one cleanout shall be required for each 40 feet of developed length of the drainage piping.
  3. Every 100 feet of horizontal run.
  4. Extend piping to accessible surface. Do not install piping so cleanouts must be installed in carpeted floors. In such locations, configure piping so wall type cleanouts may be used.
- D. Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have seal trap in connection with complete venting system so gasses pass freely to atmosphere with no pressure or siphon condition on water seal.
- E. Vent entire waste system to atmosphere. Join lines together in fewest practicable numbers before projecting above roof. Set back vent lines so they will not pierce roof near edge or valley. Vent line terminations shall be:
1. 6 inches minimum above roof and 12 inches minimum from any vertical surface.
  2. Same size as vent pipe.
  3. In areas where minimum design temperature is below 0 deg F or where frost or snow closure may be possible:
    - a. Vent line terminations shall be same size as vent pipe, except no smaller than 3 inches in diameter.
    - b. Vents shall terminate 10 inches minimum above roof or higher if required by local codes.
- F. Furnish and install firestopping at penetrations of fire-rated structures as required under Sections 07 8400 and 22 0501.
- G. If test tees are used for testing, plug tees so wall finish can be installed. Do not leave as exposed cleanouts.

### **3.2 FIELD QUALITY CONTROL**

- A. Field Tests:
1. Conduct tests for leaks and defective work. Notify Architect before testing.
  2. Metal Pipe System: After backfilling and compacting of trenches is complete but before placing floor slab, fill waste and vent system with water to roof level or 10 feet minimum, and show no leaks for two hours. Uncover pipe and correct leaks and defective work. Re-backfill and compact and re-test.
    - a. After backfilling and compacting of trenches is complete but before placing floor slab, re-test as specified above. Uncover pipe and correct leaks and defective work. Re-backfill and compact and re-test.

**END OF SECTION**

**SECTION 22 1319****FACILITY SANITARY SEWER SPECIALTIES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Products Furnished But Not Installed Under this Section as described in Contract Documents.
- B. Related Requirements:
  - 1. Section 22 0501: 'Common Plumbing Requirements'.
  - 2. Section 22 1313: 'Facility Sanitary Sewers' for installation of miscellaneous sanitary sewer specialties.

**PART 2 - PRODUCTS****2.1 SYSTEMS**

- A. Manufacturers:
  - 1. Manufacturer Contact List:
    - a. Josam Co, Michigan City, IN [www.josam.com](http://www.josam.com).
    - b. Jay R. Smith Manufacturing Co, Montgomery, AL [www.jrsmith.com](http://www.jrsmith.com).
    - c. Mifab Manufacturing Inc, Chicago, IL [www.mifab.com](http://www.mifab.com).
    - d. Proset Systems, Lawrenceville, GA [www.prosetsystems.com](http://www.prosetsystems.com).
    - e. Sioux Chief Manufacturing Co, Peculiar, MO [www.siouxchief.com](http://www.siouxchief.com).
    - f. Sureseal Manufacturing, Tacoma WA [www.thesureseal.com](http://www.thesureseal.com).
      - 1) Contact Information:
        - a) All Areas except Idaho and Utah: Rick Ensley (253) 564-0624, [rick@thesureseal.com](mailto:rick@thesureseal.com).
        - b) Idaho and Utah Areas: Mark Evans, phone (801) 748-1222, [mark@franklinjames.com](mailto:mark@franklinjames.com).
    - g. Wade Div Tyler Pipe, Tyler, TX [www.wadedrains.com](http://www.wadedrains.com).
    - h. Watts Drainage, Spindale, NC [www.watts.com](http://www.watts.com) or Watts Industries, Burlington, ON, Canada [www.wattscda.com](http://www.wattscda.com).
    - i. Zurn Industries, LLC, Erie PA [www.zurn.com](http://www.zurn.com). or Zurn Industries Ltd, Mississauga, ON (905) 795-8844.
- B. Performance:
  - 1. Design Criteria:
    - a. All materials NOT required to be low lead compliant.
- C. Components:
  - 1. Drains And Drain Accessories:
    - a. Floor Drain FD-1:
      - 1) Approved types with deep seal trap and chrome plated strainer.
      - 2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
        - a) Josam: 30000-50-Z-5A.
        - b) J. R. Smith: 2010-A.
        - c) Mifab: F-1100-C.
        - d) Sioux Chief: 832.
        - e) Wade: 1100.
        - f) Watts: FD-200-A.
        - g) Zurn: Z-415.
- D. Accessories:
  - 1. Drain Accessories:
    - a. Floor Drains:

- 1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
  - a) Trap guard by Proset Systems. Provide model number to match floor drain.
  - b) Trap seal by Sureseal. Provide model number to match floor drain.

**PART 3 - EXECUTION: Not Used**

**END OF SECTION**

**DIVISION 23: HEATING, VENTILATING, AND AIR-CONDITIONING**

**23 0000 HEATING, VENTILATING, AND AIR-CONDITIONING**

- 23 0501 COMMON HVAC REQUIREMENTS
- 23 0513 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
- 23 0529 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
- 23 0548 VIBRATION SEISMIC CONTROL FOR HVAC PIPING AND EQUIPMENT
- 23 0553 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
- 23 0713 DUCT INSULATION
- 23 0719 HVAC PIPING INSULATION
- 23 0933 ELECTRIC AND ELECTRONIC CONTROL SYSTEM FOR HVAC

**23 1000 FACILITY FUEL SYSTEMS**

- 23 1123 FACILITY NATURAL GAS PIPING

**23 2000 HVAC PIPING AND PUMPS**

- 23 2300 REFRIGERANT PIPING
- 23 2600 CONDENSATE DRAIN PIPING

**23 3000 HVAC AIR DISTRIBUTION**

- 23 3001 COMMON DUCT REQUIREMENTS
- 23 3114 LOW-PRESSURE METAL DUCTS
- 23 3300 AIR DUCT ACCESSORIES
- 23 3346 FLEXIBLE DUCT
- 23 3713 DIFFUSERS, REGISTER AND GRILLES
- 23 3723 HVAC GRAVITY VENTILATORS

**23 4000 HVAC AIR CLEANING DEVICE**

- 23 4100 AIR FILTERS

**23 5000 CENTRAL HEATING EQUIPMENT**

- 23 5135 AIR PIPING
- 23 5417 GAS-FIRED FURNACES

**23 6000 CENTRAL COOLING EQUIPMENT**

- 23 6214 COMPRESSOR UNITS: AIR CONDITIONING (5 TONS OR LESS)

**END OF TABLE OF CONTENTS**



**SECTION 23 0501****COMMON HVAC REQUIREMENTS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Common requirements and procedures for HVAC systems.
  - 2. Responsibility for proper operation of electrically powered equipment furnished under this Division.
  - 3. Interface with Testing And Balancing Agency.
  - 4. Furnish and install sealants relating to installation of systems installed under this Division.
  - 5. Furnish and install Firestop Penetration Systems for HVAC system penetrations as described in Contract Documents.
  - 6. Furnish and install sound, vibration, and seismic control elements.
- B. Products Furnished But Not Installed Under This Section:
  - 1. Sleeves, inserts, and equipment for mechanical systems installed under other Sections.
- C. Related Requirements:
  - 1. Section 03 3111: 'Cast-In-Place Structural Concrete' for exterior concrete pads and bases for mechanical equipment.
  - 2. Section 05 0523: 'Metal Fastening' for quality and requirements for welding.
  - 3. Section 07 8400: 'Firestopping' for quality of Penetration Firestop Systems to be used on Project and submittal requirements.
  - 4. Section 07 9213: 'Elastometric Joint Sealant' for quality of sealants used at building exterior.
  - 5. Section 07 9219: 'Acoustical Joint Sealants' for quality of acoustical sealants.
  - 6. Sections Under 09 9000 Heading: Painting of mechanical items requiring field painting.
  - 7. Section 26 2913: 'Enclosed Controllers' for magnetic starters and thermal protective devices (heaters) not factory mounted integral part of mechanical equipment.
  - 8. Division 26: Raceway and conduit, unless specified otherwise, line voltage wiring, outlets, and disconnect switches.
  - 9. Slots and openings through floors, walls, ceilings, and roofs provided under other Divisions in their respective materials.
  - 10. Sections Under 33 5000 Heading: Fuel Distribution Utilities.

**1.2 SUBMITTALS**

- A. Action Submittals:
  - 1. Product Data:
    - a. Manufacturer's catalog data for each manufactured item.
      - 1) Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
      - 2) Include name, address, and phone number of each supplier.
    - b. The mechanical contractor shall verify motor voltages with the electrical drawings before ordering motorized equipment and controls. Motor name plate voltage shall be NEMA standard 200 volt for 208 volt three phase or single phase system. Starter heaters installed shall be coordinated with the name plate data.
  - 2. Shop Drawings:
    - a. Schematic control diagrams for each separate fan system, heating system, control panel, etc. Each diagram shall show locations of all control and operational components and devices. Mark correct operating settings for each control device on these diagrams.

- b. Diagram for electrical control system showing wiring of related electrical control items such as firestats, fuses, interlocks, electrical switches, and relays. Include drawings showing electrical power requirements and connection locations.
  - c. Drawing of each temperature control panel identifying components in panels and their function.
  - d. Other shop drawings required by Division 23 trade Sections.
- B. Closeout Submittals:
- 1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    - a. Operations and Maintenance Data (Modify and add to requirements of Section 01 7800):
      - 1) At beginning of HVAC section of Operations And Maintenance Manual, provide master index showing items included.
        - a) Provide name, address, and phone number of Architect, Architect's Mechanical Engineer, General Contractor, and HVAC, Sheet Metal, Refrigeration, and Temperature Control subcontractors.
        - b) Identify maintenance instructions by using same equipment identification used in Contract Drawings. Maintenance instructions shall include:
          - (1) List of HVAC equipment used indicating name, model, serial number, and nameplate data of each item together with number and name associated with each system item.
          - (2) Manufacturer's maintenance instructions for each piece of HVAC equipment installed in Project. Instructions shall include name of vendor, installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance and lubrication instructions.
          - (3) Summary list of mechanical equipment requiring lubrication showing name of equipment, location, and type and frequency of lubrication.
          - (4) Manual for Honeywell Prestige thermostat published by Honeywell.
      - c) Provide operating instructions to include:
        - (1) General description of each HVAC system.
        - (2) Step by step procedure to follow in putting each piece of HVAC equipment into operation.
        - (3) Provide diagrams for electrical control system showing wiring of items such as smoke detectors, fuses, interlocks, electrical switches, and relays.
  - b. Warranty Documentation:
    - 1) Include copies of warranties required in individual Sections of Division 23.
  - c. Record Documentation:
    - 1) Manufacturers documentation:
      - a) Copies of approved shop drawings.

### 1.3 QUALITY ASSURANCE

- A. Regulatory Agency Sustainability Approvals:
- 1. Perform work in accordance with applicable provisions of Gas Ordinances applicable to Project. Provide materials and labor necessary to comply with rules, regulations, and ordinances.
  - 2. In case of differences between building codes, laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Notify Architect in writing of such differences before performing work affected by such differences.
  - 3. Identification:
    - a. Motor and equipment name plates as well as applicable UL / ULC and AGA / CGA labels shall be in place when Project is turned over to Owner.
- B. Qualifications: Requirements of Section 01 4301 applies, but not limited to following:
- 1. Company:
    - a. Company specializing in performing work of this section.
      - 1) Minimum five (5) years experience in HVAC installations.
      - 2) Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
    - b. Upon request, submit documentation.
  - 2. Installer:

- a. Licensed for area of Project.
- b. Designate one (1) individual as project foremen who shall be on site at all times during installation and experienced with installation procedures required for this project.
- c. Upon request, submit documentation.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery And Acceptance Requirements:
  1. Accept valves on site in shipping containers with labeling in place.
- B. Storage And Handling Requirements:
  1. In addition to requirements specified in Division 01:
    - a. Stored material shall be readily accessible for inspection by Architect until installed.
    - b. Store items subject to moisture damage, such as controls, in dry, heated spaces.
    - c. Provide temporary protective coating on cast iron and steel valves.
    - d. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
  2. Protect bearings during installation. Thoroughly grease steel shafts to prevent corrosion.

#### **1.5 WARRANTY**

- A. Manufacturer Warranty:
  1. Provide certificates of warranty for each piece of equipment made out in favor of Owner. Clearly record 'start-up' date of each piece of equipment on certificate.
- B. Special Warranty:
  1. Guarantee HVAC systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.
  2. If HVAC sub-contractor with offices located more than 150 miles from Project site is used, provide service / warranty work agreement for warranty period with local HVAC sub-contractor approved by Architect. Include copy of service / warranty agreement in warranty section of Operation And Maintenance Manual.

### **PART 2 - PRODUCTS**

#### **2.1 COMPONENTS**

- A. Components shall bear Manufacturer's name and trade name. Equipment and materials of same general type shall be of same make throughout work to provide uniform appearance, operation, and maintenance.
- B. Pipe And Pipe Fittings:
  1. Use domestic made pipe and pipe fittings on Project.
  2. Weld-O-Let and Screw-O-Let fittings are acceptable.
- C. Sleeves:
  1. In Framing: Standard weight galvanized iron pipe, Schedule 40 PVC, or 14 ga galvanized sheet metal two sizes larger than bare pipe or insulation on insulated pipe.
  2. In Concrete And Masonry: Sleeves through outside walls, interior shear walls, and footings shall be schedule 80 black steel pipe with welded plate.
- D. Valves:
  1. Valves of same type shall be of same manufacturer.

## **PART 3 - EXECUTION**

### **3.1 INSTALLERS**

- A. Acceptable Installers:
1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

### **3.2 EXAMINATION**

- A. Drawings:
1. HVAC Drawings show general arrangement of piping, ductwork, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
  2. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over HVAC Drawings.
  3. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.
- B. Verification Of Conditions:
1. Examine premises to understand conditions that may affect performance of work of this Division before submitting proposals for this work. Examine adjoining work on which mechanical work is dependent for efficiency and report work that requires correction.
  2. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.
  3. Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.
  4. Check that slots and openings provided under other Divisions through floors, walls, ceilings, and roofs are properly located. Perform cutting and patching caused by neglecting to coordinate with Divisions providing slots and openings at no additional cost to Owner.
- C. Electrical Coordination:
1. The contractor shall verify motor voltages with the electrical drawings before ordering motorized equipment and controls. Motor name plate voltage shall be NEMA standard 200 volt for 208 volt three phase system and shall be NEMA standard 200 volt for 208 volt three phase or single phase. Starter heaters installed shall be coordinated with the name plate data.

### **3.3 PREPARATION**

- A. Changes Due To Equipment Selection:
1. Where equipment specified or otherwise approved requires different arrangement or connections from that shown in Contract Documents, submit drawings, if requested by Architect, showing proposed installations.
  2. If proposed changes are approved, install equipment to operate properly and in harmony with intent of Contract Documents. Make incidental changes in piping, ductwork, supports, installation, wiring, heaters, panelboards, and as otherwise necessary.
  3. Provide any additional motors, valves, controllers, fittings, and other additional equipment required for proper operation of system resulting from selection of equipment.
  4. Be responsible for the proper location of roughing-in and connections provided under other Divisions.

### 3.4 INSTALLATION

- A. Interface With Other Work:
1. Furnish sleeves, inserts, supports, and equipment that are to be installed by others in sufficient time to be incorporated into construction as work proceeds. Locate these items and see they are properly installed.
  2. Electrical: Furnish exact location of electrical connections and complete information on motor controls to installer of electrical system.
  3. Testing And Balancing:
    - a. Put HVAC systems into full operation and continue their operation during each working day of testing and balancing.
    - b. Make changes in pulleys, belts, fan speeds, and dampers or add dampers as required for correct balance as recommended by Testing And Balancing Agency and at no additional cost to Owner.
- B. Cut carefully to minimize necessity for repairs to previously installed or existing work. Do not cut beams, columns, or trusses.
- C. Locating Equipment:
1. Arrange pipes, ducts, and equipment to permit ready access to valves, cocks, unions, traps, filters, starters, motors, control components, and to clear openings of doors and access panels.
  2. Adjust locations of pipes, ducts, switches, panels, and equipment to accommodate work to interferences anticipated and encountered.
  3. Install HVAC work to permit removal of equipment and parts of equipment requiring periodic replacement or maintenance without damage to or interference with other parts of equipment or structure.
  4. Determine exact route and location of each pipe and duct before fabrication.
    - a. Right-Of-Way:
      - 1) Lines that pitch shall have right-of-way over those that do not pitch. For example, steam, steam condensate, and drains shall normally have right-of-way.
      - 2) Lines whose elevations cannot be changed shall have right-of-way over lines whose elevations can be changed.
    - b. Offsets, Transitions, and Changes in Direction:
      - 1) Make offsets, transitions, and changes in direction in pipes and ducts as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.
      - 2) Furnish and install all traps, air vents, sanitary vents, and devices as required to effect these offsets, transitions, and changes in direction.
- D. Piping:
1. Furnish and install complete system of piping, valved as indicated or as necessary to completely control entire apparatus.
    - a. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper erection of systems of piping in every respect.
    - b. Arrange piping to not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings.
      - 1) Arrange so as to facilitate removal of tube bundles.
      - 2) Provide accessible flanges or ground joint unions, as applicable for type of piping specified, at connections to equipment and on bypasses.
        - a) Make connections of dissimilar metals with di-electric unions.
        - b) Install valves and unions ahead of traps and strainers. Provide unions on both sides of traps.
      - 3) Do not use reducing bushings, street elbows, bull head tees, close nipples, or running couplings.
      - 4) Install piping systems so they may be easily drained. Provide drain valves at low points and manual air vents at high points in hot water heating and cooling water piping.
      - 5) Install piping to insure noiseless circulation.

- 6) Place valves and specialties to permit easy operation and access. Valves shall be regulated, packed, and glands adjusted at completion of work before final acceptance.
- c. Do not install piping in shear walls.
- 2. Properly make adequate provisions for expansion, contraction, slope, and anchorage.
  - a. Cut piping accurately for fabrication to measurements established at site. Remove burr and cutting slag from pipes.
  - b. Work piping into place without springing or forcing. Make piping connections to pumps and other equipment without strain at piping connection. Remove bolts in flanged connections or disconnect piping to demonstrate that piping has been so connected, if requested.
  - c. Make changes in direction with proper fittings.
  - d. Expansion of Thermoplastic Pipe:
    - 1) Provide for expansion in every 30 feet of straight run.
    - 2) Provide 12 inch offset below roof line in each vent line penetrating roof.
- 3. Provide sleeves around pipes passing through concrete or masonry floors, walls, partitions, or structural members. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete floors on grade. Seal sleeves with specified sealants.
  - a. Sleeves through floors shall extend 1/4 inch above floor finish in mechanical equipment rooms above basement floor. In other rooms, sleeves shall be flush with floor.
  - b. Sleeves through floors and foundation walls shall be watertight.
- 4. Provide spring clamp plates (escutcheons) where pipes run through walls, floors, or ceilings and are exposed in finished locations of building. Plates shall be chrome plated heavy brass of plain pattern and shall be set tight on pipe and to building surface.
- 5. Remove dirt, grease, and other foreign matter from each length of piping before installation.
- E. Penetration Firestops: Install Penetration Firestop System appropriate for penetration at HVAC system penetrations through walls, ceilings, roofs, and top plates of walls.
- F. Sealants:
  - 1. Seal openings through building exterior caused by penetrations of elements of HVAC systems.
  - 2. Furnish and install acoustical sealant to seal penetrations through acoustically insulated walls and ceilings.

### 3.5 REPAIR / RESTORATION

- A. Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.
  - 1. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown.
  - 2. Surface finishes shall exactly match existing finishes of same materials.

### 3.6 FIELD QUALITY CONTROL

- A. Field Tests:
  - 1. Perform tests on HVAC piping systems. Furnish devices required for testing purposes.
- B. Non-Conforming Work:
  - 1. Replace material or workmanship proven defective with sound material at no additional cost to Owner.
  - 2. Repeat tests on new material, if requested.

### 3.7 SYSTEM START-UP

- A. Off-Season Start-up:
  - 1. If Substantial Completion inspection occurs during heating season, schedule spring start-up of cooling systems. If inspection occurs during cooling season, schedule autumn start-up for heating systems.
  - 2. Notify Owner seven days minimum before scheduled start-up.

3. Time will be allowed to completely service, test, check, and off-season start systems. During allowed time, train Owner's representatives in operation and maintenance of system.
  4. At end of off-season start-up, furnish Owner with letter confirming that above work has been satisfactorily completed.
- B. Preparations that are to be completed before start up and operation include, but are not limited to, following:
1. Dry out electric motors and other equipment to develop and properly maintain constant insulation resistance.
  2. Make adjustments to insure that:
    - a. Equipment alignments and clearances are adjusted to allowable tolerances.
    - b. Nuts and bolts and other types of anchors and fasteners are properly and securely fastened.
    - c. Packed, gasketed, and other types of joints are properly made up and are tight and free from leakage.
    - d. Miscellaneous alignments, tightenings, and adjustments are completed so systems are tight and free from leakage and equipment performs as intended.
  3. Motors and accessories are completely operable.
  4. Inspect and test electrical circuitry, connections, and voltages to be properly connected and free from shorts.
  5. Adjust drives for proper alignment and tension.
  6. Make certain filters in equipment for moving air are new and of specified type.
  7. Properly lubricate and run-in bearings in accordance with Manufacturer's directions and recommendations.

### 3.8 CLEANING

- A. Clean exposed piping, ductwork, and equipment.
- B. No more than one week before Final Inspection, flush out bearings and clean other lubricated surfaces with flushing oil. Provide best quality and grade of lubricant specified by Equipment Manufacturer.
- C. Replace filters in equipment for moving air with new filters of specified type no more than one week before Final Inspection.

### 3.9 CLOSEOUT ACTIVITIES

- A. Instruction Of Owner:
  1. Instruct building maintenance personnel and Stake Physical Facilities Representative in operation and maintenance of mechanical systems utilizing Operation And Maintenance Manual when so doing:
    - a. Minimum Instruction Periods:
      - 1) HVAC and Refrigeration: Four (4) hours.
      - 2) Temperature Control: Four (4) hours.
    - b. Conduct instruction periods after Substantial Completion inspection when systems are properly working and before final payment is made. None of these instructional periods shall overlap another.

### 3.10 PROTECTION

- A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system. Cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of system. Do not use plugs of rags, wool, cotton waste, or similar materials.
- B. Do not operate pieces of equipment used for moving supply air without proper air filters installed properly in system.

- C. After start-up, continue necessary lubrication and be responsible for damage to bearings while equipment is being operated up to Substantial Completion.

**END OF SECTION**



**SECTION 23 0513****COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Quality of motors used in designated mechanical equipment.
- B. Related Requirements:
  - 1. Section 23 0501: Common HVAC Requirements.

**1.2 REFERENCE**

- A. Reference Standards:
  - 1. Institute of Electrical and Electronics Engineers:
    - a. IEEE Std C50.13-2005, 'Standard for Cylindrical-Rotor 50 Hz and 60 Hz Synchronous Generators Rated 10 MVA and Above.'

**PART 2 - PRODUCTS****2.1 MANUFACTURED UNITS**

- A. Manufacturers:
  - 1. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories.
    - a. General Electric Industrial Systems, Fort Wayne, IN [www.geindustrial.com](http://www.geindustrial.com).
    - b. Marathon Electric Co, Cleveland, OH [www.marathonelectric.com](http://www.marathonelectric.com).
    - c. Reliance Electric, Cleveland, OH [www.reliance.com](http://www.reliance.com).
    - d. Siemens Energy & Automation, Alphrata, GA [www.sea.siemens.com](http://www.sea.siemens.com).
    - e. Toshiba International Corp, Houston, TX [www.tic.toshiba.com](http://www.tic.toshiba.com).
- B. Performance:
  - 1. Design Criteria:
    - a. Construct for use at altitude where Project is located.
    - b. Guaranteed to operate continuously at 115 percent of full load with temperature rise in any part not to exceed 40 deg F.
    - c. Premium efficiency type motor, unless noted otherwise.
    - d. Inverter rated if for variable frequency drive application.
- C. Motors:
  - 1. Comply with requirements of IEEE Std C50 (ANSI C50), and all NEMA Standards.
  - 2. Drip-proof, unless otherwise noted.
  - 3. Ball, sleeve, or roller bearings with dustproof and leakproof rings.
  - 4. Adequately braced and air-cooled windings.
  - 5. Provide motors for V-belt drives with cast-iron or steel base, with slide rail and adjustable screw device and isolate by rubber-in-shear devices.
  - 6. Commercially dynamically balanced and tested at factory before shipment.
    - a. Selected for quiet operation.
    - b. Sound power levels within NEMA MGI-12.49.
  - 7. Motors 3/4 HP and larger: Squirrel-cage type and designed for 3 phase 60 cycle 208V power, unless otherwise specified.
  - 8. Motors smaller than 3/4 HP: 120V 60-cycle single phase, unless otherwise specified.
  - 9. Provide each motor with nameplate for electrical characteristics.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Line up motors and drives and place motors and equipment on foundations ready for operation.

**END OF SECTION**

**SECTION 23 0529****HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Common hanger and support requirements and procedures for HVAC systems.
- B. Related Requirements:
  - 1. Section 05 0523: 'Metal Fastening' for quality and requirements for welding.
  - 2. Section 07 8400: 'Firestopping' for quality of Penetration Firestop Systems to be used on Project and submittal requirements.
  - 3. Slots and openings through floors, walls, ceilings, and roofs provided under other Divisions in their respective materials.
- C. Products Installed But Not Furnished Under This Section:
  - 1. Stencils and band colors of gas piping used in HVAC equipment.
- D. Related Requirements:
  - 1. Section 09 9124: 'Interior Painted Metal' for providing field painting of identification of piping used with HVAC equipment.
  - 2. Section 23 0553: 'Identification For HVAC Piping And Equipment' for HVAC piping and equipment identification signage requirements.
  - 3. Sections Under 09 9000 Heading: Painting of mechanical items requiring field painting.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Section 09 9124 to coordinate with Section 23 0529 for location of identification of HVAC piping and equipment to be field painted and Section 23 0553 for painting requirements of HVAC piping and equipment.
  - 2. Section 23 0529 to coordinate with Section 23 0553 for stencil and band color locations and identification requirements of HVAC piping and equipment for field application.

**1.3 SUBMITTALS**

- A. Action Submittals:
  - 1. Product Data:
    - a. Manufacturer's catalog data for each manufactured item.

**PART 2 - PRODUCTS****2.1 ASSEMBLIES**

- A. Manufacturers:
  - 1. Class Two Quality Standard Approved Manufacturers. See Section 01 6200:
    - a. Anvil International, Portsmouth, NH [www.anvilintl.com](http://www.anvilintl.com).
    - b. Cooper B-Line, Highland, IL [www.cooperblinc.com](http://www.cooperblinc.com).
    - c. Erico International, Solon, OH [www.erico.com](http://www.erico.com).
    - d. Hilti Inc, Tulsa, OK [www.hilti.com](http://www.hilti.com).
    - e. Minerallac, Hampshire, IL [www.minerallac.com](http://www.minerallac.com).
    - f. Thomas & Betts, Memphis, TN [www.superstrut.com](http://www.superstrut.com).
    - g. Unistrut, Wayne, MI [www.unistrut.com](http://www.unistrut.com).

B. Performance:

1. Design Criteria:

- a. Support rods for single pipe shall be in accordance with following table:

Rod Diameter	Pipe Size
3/8 inch	2 inches and smaller
1/2 inch	2-1/2 to 3-1/2 inches
5/8 inch	4 to 5 inches
3/4 inch	6 inches
7/8 inch	8 to 12 inches

- b. Support rods for multiple pipes supported on steel angle trapeze hangers shall be in accordance with following table:

Rods		Number of Pipes per Hanger for Each Pipe Size						
No.	Diameter	2 Inch	2.5 Inch	3 Inch	4 Inch	5 Inch	6 Inch	8 Inch
2	3/8 Inch	Two	0	0	0	0	0	0
2	1/2 Inch	Three	Three	Two	0	0	0	0
2	5/8 Inch	Six	Four	Three	Two	0	0	0
2	5/8 Inch	Nine	Seven	Five	Three	Two	Two	0
2	5/8 Inch	Twelve	Nine	Seven	Five	Three	Two	Two

- 1) Size trapeze angles so bending stress is less than 10,000 psi.

C. Materials:

1. Hangers, Rods, Channels, Attachments, And Inserts:

- a. Galvanized and UL approved for service intended.
- b. Support horizontal piping from clevis hangers or on roller assemblies with channel supports, except where trapeze type hangers are explicitly shown on Drawings. Hangers shall have double nuts.
- c. Class Two Quality Standards:
  - 1) Support insulated pipes with clevis hanger equal to Anvil Fig 260 or roller assembly equal to Anvil Fig 171 with an insulation protection shield equal to Anvil Fig 167. Gauge and length of shield shall be in accordance with Anvil design data.
  - 2) Except uninsulated copper pipes, support uninsulated pipes from clevis hanger equal to Anvil Fig 260. Support uninsulated copper pipe from hanger equal to Anvil Fig CT-65 copper plated hangers and otherwise fully suitable for use with copper tubing.
- d. Riser Clamps For Vertical Piping:
  - 1) Class Two Quality Standard: Anvil Figure 261.
- e. Concrete Inserts:
  - 1) Suitable for special nuts size 3/8 inch through 7/8 inch with yoke to receive concrete reinforcing rods, and with malleable iron lugs for attaching to forms.
  - 2) Class Two Quality Standards:
    - a) Standard Inserts: Anvil Figure 282.
  - 3) Class One Quality Standards:
    - a) Continuous Inserts: Unistrut P-3200 series.
    - b) Acceptable Manufacturers: Hilti, Thomas & Betts.
    - c) Equal as approved by Architect before installation. See Section 01 6200.
- f. Steel Deck Bracket:
  - 1) 6 inch length minimum.
  - 2) Class One Quality Standard: Unistrut P1000 with clamp nut.
  - 3) Acceptable Manufacturers: Hilti, Thomas & Betts.
  - 4) Equal as approved by Architect before installation. See Section 01 6200.
- g. Furnace Support Channel:
  - 1) Class One Quality Standard: Unistrut P1000.
  - 2) Acceptable Manufacturers: Hilti, Thomas & Betts.
  - 3) Equal as approved by Architect before installation. See Section 01 6200.
- h. Swivel Attachment:
  - 1) Class One Quality Standard: Unistrut EM3127.
  - 2) Acceptable Manufacturers: Hilti, Thomas & Betts.
  - 3) Equal as approved by Architect before installation. See Section 01 6200.

**PART 3 - EXECUTION****3.1 INSTALLATION****A. Interface With Other Work:**

1. Furnish inserts for attaching hangers that are to be cast in concrete floor construction to Division 03 at time floors are poured.

**B. Piping:**

1. Properly support piping and make adequate provisions for expansion, contraction, slope, and anchorage.
  - a. Except for underground pipe, suspend piping from roof trusses or clamp to vertical walls using support channels and clamps. Do not hang pipe from other pipe, equipment, or ductwork. Laying of piping on any building element is not allowed.
  - b. Supports For Horizontal Piping:
    - 1) Support metal piping at 96 inches on center maximum for pipe 1-1/4 inches or larger and 72 inches on center maximum for pipe 1-1/8 inch or less.
    - 2) Support thermoplastic pipe at 48 inches on center maximum.
    - 3) Provide support at each elbow. Install additional support as required.
  - c. Supports for Vertical Piping:
    - 1) Place riser clamps at each floor or ceiling level.
    - 2) Securely support clamps by structural members, which in turn are supported directly from building structure.
    - 3) Provide clamps as necessary to brace pipe to wall.
  - d. Install supports from inserts cast into concrete floor system, including concrete joists and floor slabs. Where inserts cannot be used, provide expansion shields and support hangers from angles held in place by expansion bolts, never directly from expansion bolt itself. Provide calculations necessary to determine number of expansion bolts required to equal capacity of cast-in-place insert.
  - e. Insulate hangers for copper pipe from piping by means of at least two layers of Scotch 33 plastic tape.

**END OF SECTION**

**SECTION 23 0548****VIBRATION AND SEISMIC CONTROL FOR HVAC PIPING AND EQUIPMENT****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Quality of and requirements for anchorage and seismic restraint systems and vibration isolation systems for HVAC piping and equipment.
- B. Related Requirements:
  - 1. Section 03 3053: 'Miscellaneous Exterior Cast-In-Place Concrete'.
  - 2. Furnishing and installing of seismic restraint and vibration isolation systems is by installer of equipment requiring such systems. Manufacturers of equipment specified for seismic restraint shall provide product data needed for calculation of seismic restraint needs. This information shall include, but not be limited to, equipment dimensions, dimensioned anchor points, operating weight, and center of gravity dimension.

**1.2 REFERENCES**

- A. Association Publications:
  - 1. Federal Emergency Management Agency (FEMA) / Vibration Isolation and Seismic Control Manufacturers Association (VISCMA) / American Society of Civil Engineers (ASCE):
    - a. FEMA 412, 'Installing Seismic Restraints For Mechanical Equipment' (December 2002).
  - 2. Vibration Isolation and Seismic Control Manufacturers Association (VISCMA):
    - a. VISCMA 101-12, 'Seismic Restraint Specification Guidelines for Mechanical, Electrical, and Plumbing Systems'.
    - b. VISCMA 102-12, 'Vibration Isolation Specification Guidelines for Mechanical, Electrical, and Plumbing Systems'.
- B. Definitions:
  - 1. Vibration Isolation: Vibration reduction in which an isolation system is placed between the source of unwanted vibration and an item which needs to be shielded from the vibration.
- C. Reference Standards:
  - 1. American National Standards Institute / Sheet Metal And Air Conditioning Contractors' National Association:
    - a. ANSI/SMACNA 001-2008, 'Seismic Restraint Manual: Guidelines For Mechanical Systems' (3rd Edition).
  - 2. American Society of Civil Engineers / Structural Engineering Institute:
    - a. ASCE/SEI 7-10, 'Minimum Design Loads for Buildings and Other Structures'.
      - 1) Chapter 13, 'Seismic Design Requirements For Nonstructural Components'.
  - 3. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
    - a. 2011 ASHRAE Handbook - HVAC Applications.
      - 1) Chapter 48, 'Noise and Vibration Control'.
      - 2) Chapter 55, 'Seismic- and Wind-Resistant Design'.
  - 4. ASTM International:
    - a. ASTM A615/A615M-12, 'Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement'.

**1.3 SUBMITTALS**

- A. Action Submittals:
  - 1. Product Data:
    - a. Restraint system and anchorage method to be used for each piece of equipment.

- b. Seismic restraints and calculations for all flexible mounted equipment.
  - c. Vibration isolators and flexible couplings.
  - d. Clearly outlined procedures for installing and adjusting isolators, seismic bracing anchors, and snubbers.
2. Shop Drawings:
- a. Show size, hanger length, and location of seismic restraints for piping and ductwork.
  - b. Show details for each isolator and seismic brace with snubbers proposed for specified equipment.
  - c. Show details for proposed structural steel frames and rails and for anchors to be used in conjunction with isolation of equipment.
  - d. Show locations of piping and ductwork restraints on installation and fabrication floor plans (not bid set of documents of floor plans), noting size and type of restraint to be used.
  - e. Show details of supports, hangers, anchorage, and bracing for isolated equipment as designed or proposed by professional engineer employed by Restraint Manufacturer and qualified with seismic experience in bracing for mechanical equipment. Shop drawings submitted for seismic bracing and anchors shall bear engineer's signed professional seal.
  - f. Include anchor bolt calculations, signed and stamped by registered engineer, showing adequacy of bolt sizing and type.
    - 1) Calculations shall include anchor embedment, minimum edge distance and minimum center distance.
    - 2) Design lateral forces shall be distributed in proportion to mass distribution of equipment.
    - 3) Furnish calculations for anchors on restraint devices, cable, isolators, and on rigidly mounted equipment.

#### 1.4 QUALITY ASSURANCE

- A. Regulatory Agency Sustainability Approvals:
  - 1. System design and installation shall meet seismic requirements as defined in ASCE/SEI 7-10, 'Minimum Design Loads for Buildings and Other Structures' and applicable state and local codes in accordance with minimum restraint capability of 1.0 g.

### PART 2 - PRODUCTS

#### 2.1 ASSEMBLIES

- A. Manufacturers:
  - 1. Type One Acceptable Manufacturers:
    - a. Amber / Booth Company, Houston, TX [www.amberbooth.com](http://www.amberbooth.com).
    - b. Mason Industries Inc, Hauppauge, NY [www.mason-ind.com](http://www.mason-ind.com).
    - c. Vibration Mountings and Control Inc, Bloomington, NJ (201) 838-1780.
    - d. Equal as approved by Architect before bidding. See Section 01 6200.
- B. Performance:
  - 1. Design Criteria:
    - a. Isolation And Seismic Equipment:
      - 1) Piping: Restrain piping in accordance with ANSI/SMACNA 001 Seismic Restraint Manual, Chapter 4, Figures 4.11 to 4.19.
      - 2) Equipment with Fixed Anchor or Support:
        - a) Restraint designed according to ASCE/SEI 7-10, Chapter 13, 'Seismic Design Requirements For Nonstructural Components'.
        - b) Horizontal force factor for elements of structures:
          - (1) In addition, vertical force restraint requirement shall be computed at 1/2 value of horizontal forces.
          - (2) Restrain equipment not anchored directly to floors by cable system designed and furnished by Restraint Manufacturer.
      - 3) Ductwork: Restrain ductwork in accordance with ANSI/SMACNA 001 Seismic Restraint Manual, Chapter 4, Figures 4.2 to 4.10 as appropriate.
    - b. Vibration Isolation Requirements:
      - 1) Isolate equipment from structure by means of resilient vibration and noise isolators.

- 2) Unless otherwise noted, isolate HVAC equipment one horsepower and over from structure by means of resilient vibration and noise isolators in accordance with ASHRAE 'Handbook - HVAC Applications', Chapter 48, Table 1, 'Design Guidelines for HVAC-Related Background Sound in Rooms'.
  - 3) Design and install isolation equipment, hangers, connections, and other isolating devices to prevent transmission of vibration to structure from equipment and associated piping and ductwork.
  - 4) For floor-mounted equipment, use recommendations with ASHRAE 'Handbook - HVAC Applications', Chapter 48, Table 1, 'Design Guidelines for HVAC-Related Background Sound in Rooms'.
  - 5) For roofs and floors constructed with open web joints, thin long span slabs, wooden construction and unusual light weight construction, evaluate equipment weighing more than 300 pounds to determine additional deflection of structure caused by equipment weight. Isolator deflection shall be 15 times additional deflection or deflection shown in ASHRAE 'Handbook - HVAC Applications', Chapter 48, Table 1, 'Design Guidelines for HVAC-Related Background Sound in Rooms', whichever is greater.
  - 6) Under-Equipment Spring Isolators:
    - a) Equal to Mason SSLFH earthquake motion restrained spring mounts with freestanding stable steel springs, leveling bolts, corrosion resistant finish, motion limiting design, uplift restraining bolts, and 1/4 inch ribbed neoprene noise stop pad.
    - b) Isolators shall accept force in any direction up to 1.0 g without failure, and shall limit movement to 3/4 inch in any direction.
    - c) Springs shall have 50 percent overload capacity.
    - d) Size as required to achieve specified static deflection.
    - e) Outer diameter of spring proper shall not be less than 0.8 of spring height when in loaded position.
  - 7) Overhead Support Spring And Rubber Hangers:
    - a) Combination spring and neoprene hangers.
    - b) Hanger bracket shall have 500 percent overload capability and shall allow up to 15 degree hanger rod misalignment without short-circuiting.
    - c) Springs shall have 50 percent overload capacity.
    - d) Provide seismic bracing as required.
  - 8) Isolate piping and ductwork in mechanical equipment room and piping and ductwork three supports away or 50 feet from other mechanical equipment, whichever is greater, from structure by means of vibration and noise isolators.
    - a) Isolate suspended piping with combination spring and fiberglass hangers in supporting rods.
    - b) Support floor-mounted piping directly on spring mounts.
  - 9) Isolate vertical pipe risers from structure using vibration and noise isolating expansion hangers having minimum rated deflection of four times anticipated pipe movement. Enclose in housing for fail-safe equipment.
  - 10) Incorporate flexible connectors in piping adjacent to reciprocating equipment.
  - 11) Incorporate flexible connections in ductwork adjacent to air-moving units.
  - 12) Elastomeric Isolator: Neoprene or high quality synthetic rubber with anti-ozone and anti-oxidant additives.
  - 13) Nuts, Bolts, And Washers: Electroplated zinc.
  - 14) Isolators Exposed To Weather: Cadmium plated and neoprene coated springs.
- c. Seismic Requirements:
- 1) Mechanical equipment, piping, and ductwork shall be braced, snubbed, or supported to withstand seismic disturbances and remain operational.
  - 2) Seismic restraint equipment and resilient isolation devices shall be designed and furnished by single Manufacturer:

C. Finishes:

1. Clean and paint steel components. Thoroughly clean structural steel bases of welding slag and prime with zinc-chromate or metal etching primer. Etch and paint hot dipped galvanized steel components.



**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. Isolation Equipment:
1. Mount vibration isolated equipment on rigid steel frames or concrete bases unless Equipment Manufacturer certifies direct attachment capability.
  2. Install snubbers with factory set clearances.
  3. Piping:
    - a. Protect isolated and non-isolated piping 2-1/2 inches inside diameter and larger in all planes by restraints to accommodate thermal movement as well as restrain seismic motions.
    - b. Locations shall be as scheduled and include, but not be limited to:
      - 1) At drops to equipment and at flexible connections.
      - 2) At 45 degree or greater changes in direction of pipe.
      - 3) At horizontal runs of pipe 30 feet maximum on center spacing.
      - 4) Gas piping shall have additional restraints as scheduled.
  4. Ductwork:
    - a. Protect isolated and non-isolated rectangular ductwork 4 feet square in cross-sectional area and larger in all planes by restraints to accommodate thermal movement as well as restrain seismic motion.
    - b. Locations shall be determined by Seismic Restraint Manufacturer and include, but not be limited to:
      - 1) Horizontal runs of ductwork 30 feet maximum on center spacing.
      - 2) 45 degree or greater changes in direction of ductwork.
      - 3) Each end of duct runs and drops of equipment.
      - 4) Each flexible connection.
- B. Vibration Isolation: Install piping and ductwork to prevent transmission of noise and vibration into structure.

**END OF SECTION**

**SECTION 23 0553****IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT****PART 1 - GENERAL****1.1 SUMMARY**

- A. Products Furnished But not Installed Under This Section:
1. Identification of new and existing HVAC piping and equipment as described in Contract Documents including:
    - a. Paint identification for gas piping used in HVAC equipment.
    - b. Stencils and band colors for gas piping used in HVAC equipment.
- B. Related Requirements:
1. Section 09 9124: 'Interior Painted Metal' for providing field painting of identification of piping used with HVAC equipment.
  2. Section 22 0529: 'Hangers And Supports For Plumbing' for field installation of pipe stencils and band colors for identification for piping used with HVAC equipment.

**PART 2 - PRODUCTS****2.1 SYSTEMS**

- A. Description:
1. Abbreviations for Pipe Stencils and Equipment Identification and Band Colors for Pipe Identification:
    - a. Apply stenciled symbols and continuous painting as follows:
 

<u>Pipe Type</u>	<u>Pipe Color</u>	<u>Symbol</u>
Gas	Yellow	GAS
- B. Materials:
1. Category Four Approved Products and Manufacturers. See Section 01 6200 for definitions of Categories:
    - a. Products listed in edition of MPI Approved Product List current at time of bidding and later are approved, providing they meet VOC requirements in force where Project is located.
  2. Description:
    - a. Ferrous Metal:
      - 1) New Surfaces: Use MPI(a) INT 5.1B Waterborne Light Industrial Finish system.
      - 2) Previously Finished Surfaces: Use MPI(r) RIN 5.1B Waterborne Light Industrial Finish system.
  3. Performance Requirements:
    - a. New Surfaces: MPI Premium Grade finish requirements.
    - b. Deteriorated Existing Surfaces: MPI Premium Grade finish requirements.
    - c. Sound Existing Surfaces: MPI Custom Grade finish requirements.
    - d. Maintain specified colors, shades, and contrasts.
  4. Paint (one coat):
    - a. Primer:
      - 1) Ferrous Metal:
        - a) MPI 107, 'Primer, Rust-Inhibitive, Water Based'.
        - (1) Color: white.
    - b. Finish Coat (two coats):
      - 1) Ferrous Metal:
        - a) MPI 153, 'Light Industrial Coating, Interior, Water Based, Semi-Gloss (MPI Gloss Level 5)'.
  5. Labels:
    - a. Equipment Identification:

- 1) Black formica, with white reveal when engraved.
- 2) Lettering to be 3/16 inch high minimum.

## **PART 3 - EXECUTION**

### **3.1 APPLICATION**

#### **A. Labels:**

1. Identify following items with specified labels fastened to equipment with screws (unless noted otherwise):
  - a. Thermostats and control panels in mechanical spaces (attach label to wall directly above or below thermostats).
  - b. Furnaces.
  - c. Condensing units.
  - d. Boilers and hot water heating specialties.
  - e. Duct furnaces.
  - f. Air handling units and fan coil units.
  - g. Electric duct heaters.
  - h. Rooftop Units.
  - i. Unit Heaters.
  - j. Accessible exhaust fans.
  - k. Chillers and chilled water specialties.
  - l. Pumps.
2. Engrave following data from Equipment Schedules on Drawings onto labels:
  - a. Equipment mark.
  - b. Area served.
  - c. Thermostat zone number, when different from equipment mark.
  - d. Panel and breaker from which unit is powered.

#### **B. Painting:**

1. New Surfaces:
  - a. Remove rust spots by sanding and immediately spot prime. If all traces of rust cannot be removed, apply rust blocker recommended by Paint Manufacturer before applying full primer coat.
2. Existing Surfaces:
  - a. Remove deteriorated existing paint down to sound substrate by scraping and sanding. Feather edges of existing paint by sanding to be smooth with adjacent surfaces. Spot prime bare metal surfaces immediately.
  - b. Remove rust spots by sanding and immediately spot prime. If all traces of rust cannot be removed, apply rust blocker recommended by Paint Manufacturer before applying full primer coat.
  - c. Clean existing sound painted surfaces as well as scraped and sanded existing painted surfaces as recommended by Paint Manufacturer.
  - d. Apply prime coat over entire surface to be painted.
  - e. Lightly sand entire surface.
  - f. Clean surface as recommended by Paint Manufacturer.
  - g. Apply finish coats.
3. Leave equipment in like-new appearance.
4. Only painted legends, directional arrows, and color bands are acceptable.
5. Locate identifying legends, directional arrows, and color bands at following points on exposed piping of each piping system:
  - a. Adjacent to each item of equipment.
  - b. At point of entry and exit where piping goes through wall.
  - c. On each riser and junction.
  - d. Every 25 feet on long continuous lines.
  - e. Stenciled symbols shall be one inch high and black.

**END OF SECTION**

**SECTION 23 0713****DUCT INSULATION****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install thermal wrap duct insulation as described in Contract Documents.
- B. Related Requirements:
  - 1. Section 23 3114: 'Low-Pressure Metal Ducts'.
  - 2. Section 23 3300: 'Acoustic Duct Accessories' for duct liner.

**PART 2 - PRODUCTS****2.1 MANUFACTURERS**

- A. Manufacturer Contact List:
  - 1. Certainteed St Gobain, Valley Forge, PA [www.certainteed.com](http://www.certainteed.com).
  - 2. Johns-Manville, Denver, CO [www.jm.com](http://www.jm.com).
  - 3. Knauf Fiber Glass, Shelbyville, IN [www.knauffiberglass.com](http://www.knauffiberglass.com) or Toronto, ON (416) 593-4322.
  - 4. Manson Insulation Inc, Brossard, QB [www.isolationmanson.com](http://www.isolationmanson.com).
  - 5. Owens-Corning, Toledo, OH or Owens-Corning Canada Inc, Willowdale, ON [www.owenscorning.com](http://www.owenscorning.com).

**2.2 MATERIALS**

- A. Thermal Wrap Duct Insulation:
  - 1. 1-1/2 inch or 3 inch thick fiberglass with factory-laminated, reinforced aluminum foil scrim kraft facing and density of 0.75 lb / per cu ft.
  - 2. Thermal Conductivity: 0.27 BTU in/HR SF deg F at 75 deg F maximum.
  - 3. Type One Acceptable Products:
    - a. Type 75 standard duct insulation by Certainteed St Gobain.
    - b. Microlite FSK by Johns-Manville.
    - c. Duct Wrap FSK by Knauf Fiber Glass.
    - d. Alley Wrap FSK by Manson Insulation Inc.
    - e. FRK by Owens-Corning.
    - f. Equal as approved by Architect before bidding. See Section 01 6200.

**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. Thermal Wrap Duct Insulation:
  - 1. Install insulation as follows:
    - a. On all supply and return ducts outside building insulation envelope.
    - b. On all round ducts.
    - c. Within Building Insulation Envelope:
      - 1) 1-1/2 inches thick on rectangular outside air ducts and combustion air ducts.
      - 2) 1-1/2 inches thick on all round ducts.
    - d. Outside Building Insulation Envelope:
      - 1) 3 inch thick on round supply and return air ducts.
      - 2) 1-1/2 inch thick on rectangular, acoustically lined, supply and return air ducts.
  - 2. Wrap insulation tightly on ductwork with circumferential joints butted and longitudinal joints overlapped minimum 2 inches.

- a. Do not compress insulation except in areas of structural interference. Minimum thickness at corners shall be one inch thick.
- b. Remove insulation from lap before stapling.
- c. Staple seams at approximately 16 inches on center with outward clenching staples.
- d. Seal seams with foil vapor barrier tape or vapor barrier mastic. Seal penetrations of facing to provide vapor tight system.

**END OF SECTION**

**SECTION 23 0719**

**HVAC PIPING INSULATION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install insulation on above ground refrigerant piping and fittings as described in Contract Documents.
  - 2. Furnish and install insulation for hot water heating and return piping system as described in Contract Documents.
  - 3. Furnish and install insulation for steam and condensate piping system as described in Contract Documents.
  
- B. Related Requirements:
  - 1. Section 23 0501: 'General HVAC Requirements'.
  - 2. Section 23 2300: 'Refrigerant Piping'.

**1.2 DELIVERY, STORAGE, AND HANDLING**

- A. Storage And Handling Requirements:
  - 1. Keep materials and work dry and free from damage.
  - 2. Replace wet or damaged materials at no additional cost to Owner.

**PART 2 - PRODUCTS**

**2.1 ASSEMBLIES**

- A. Manufacturers:
  - 1. Manufacturer Contact List:
    - a. Armacell, Mebane, NC [www.armaflex.com](http://www.armaflex.com).
    - b. Childers Products Co, Eastlake, OH [www.fosterproducts.com](http://www.fosterproducts.com).
    - c. Foster Products Corp, Oakdale, MN [www.fosterproducts.com](http://www.fosterproducts.com).
    - d. Johns-Manville, Denver, CO [www.jm.com](http://www.jm.com).
    - e. Knauf, Shelbyville, IN [www.knauffiberglass.com](http://www.knauffiberglass.com).
    - f. Manson, Brossard, BC, Canada [www.isolationmanson.com](http://www.isolationmanson.com).
    - g. Nitron Industries, Thousand Oaks, CA [www.nitronindustries.com](http://www.nitronindustries.com).
    - h. Owens-Corning, Toledo, OH [www.owenscorning.com](http://www.owenscorning.com) or Owens-Corning Canada Inc, Willowdale, ON (416) 733-1600.
    - i. Ramco, Lawrenceville, NJ [www.ramco.com](http://www.ramco.com).
    - j. Nomac, Zebulon, NC [www.nomaco.com](http://www.nomaco.com).
    - k. Speedline Corp, Solon, OH [www.speedlinepvc.com](http://www.speedlinepvc.com).
  
- B. Materials:
  - 1. Refrigeration Piping System:
    - a. Thickness:

Pipe Size, Outside Diameter	Insulation Thickness
One inch and smaller	1/2 Inch
1-1/8 to 2 inch	3/4 Inch

- 1) One inch sheet for fittings as recommended by Manufacturer.
- 2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
  - a) AP Armaflex 25/50 by Armstrong.
  - b) Nitrolite by Nitron Industries. White only for exterior.

- c) Nomaco K-Flex.
- b. Joint Sealer:
  - 1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - a) Armacell 520 by Armstrong.
    - b) Namaco K-Flex R-373.
- c. Insulation Tape:
  - 1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - a) Armaflex AP Insul Tape by Armstrong.
    - b) FT182 Tape by Nitron Industries.
    - c) Elastomeric Foamtape by Nomac K-Flex.
- d. Exterior Finish:
  - 1) For application to non-white, exterior insulation.
  - 2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - a) WB Armaflex Finish by Armstrong.
    - b) R-374 Protective Coating by Nomaco K-Flex.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Before application of insulating materials, brush clean surfaces to be insulated and make free from rust, scale, grease, dirt, moisture, and any other deleterious materials.
- B. Use drop cloths over equipment and structure to prevent adhesives and other materials spotting the work.

### **3.2 INSTALLATION**

- A. Refrigeration System Piping System:
  - 1. General:
    - a. Install insulation in snug contact with pipe.
      - 1) Insulate flexible pipe connectors.
      - 2) Insulate thermal expansion valves with insulating tape.
      - 3) Insulate fittings with sheet insulation and as recommended by Manufacturer.
    - b. Slip insulation on tubing before tubing sections and fittings are assembled keeping slitting of insulation to a minimum.
    - c. Do not install insulation on lines through clamp assembly of pipe support. Butt insulation up against sides of clamp assembly.
    - d. Stagger joints on layered insulation. Seal joints in insulation.
    - e. Install insulation exposed outside building so 'slit' joint seams are placed on bottom of pipe.
    - f. Paint exterior exposed, non-white insulation with two coats of specified exterior finish.
  - 2. System Requirements:
    - a. Condensing Units: Install insulation on above ground refrigerant suction piping and fittings, including thermal bulb, from thermal expansion valve.
    - b. Split System Heat Pump Units: Install insulation on above ground refrigerant liquid and suction piping and fittings.

### **3.3 FIELD QUALITY CONTROL**

- A. Non-Conforming Work:
  - 1. Method of installing insulation shall be subject to approval of Architect. Sloppy or unworkmanlike installations are not acceptable.

### **3.4 CLEANING**

- A. Leave premises thoroughly clean and free from insulating debris.

**3.5 PROTECTION**

- A. Protect insulation wherever leak from valve stem or other source might drip on insulated surface, with aluminum cover or shield rolled up at edges and sufficiently large in area and of shape that dripping will not splash on surrounding insulation.

**END OF SECTION**



**SECTION 23 0933****ELECTRIC AND ELECTRONIC CONTROL SYSTEM FOR HVAC****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install automatic temperature control system as described in Contract Documents.
  - 2. Furnish and install conductors and make connections to control devices, motors, and associated equipment.
  - 3. Assist in air test and balance procedure.
  
- B. Related Requirements:
  - 1. Section 01 4546: Duct testing, adjusting, and balancing of ductwork.
  - 2. Section 23 0501: Common HVAC Requirements.
  - 3. Section 23 3300: Furnishing and installing of temperature control dampers.
  - 4. Division 26:
    - a. Furnishing and installing of raceway, conduit, and junction boxes, including pull wires, for temperature control system except as noted above.
    - b. Power wiring to magnetic starters, disconnect switches, and motors.
    - c. Motor starters and disconnect switches, unless integral with packaged equipment.

**1.2 SUBMITTALS**

- A. Action Submittals:
  - 1. Product Data:
    - a. Installer to provide product literature or cut sheets for all products specified in Project.
    - b. Installer to provide questions of control equipment locations to Mechanical Engineer prior to installation.
  
- B. Informational Submittals:
  - 1. Certificates:
    - a. Installer must provide 'Certificate of Sponsorship' signed from Approved Distributor with bid confirming Installer sponsorship.
  
- C. Closeout Submittals:
  - 1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    - a. Operations and Maintenance Data:
      - 1) Leave with O&M Manual specified in Section 23 0501.
    - b. Record Documentation:
      - 1) Installer's 'Certificate of Sponsorship'.

**1.3 QUALITY ASSURANCE**

- A. Qualifications: Requirements of Section 01 4301 applies, but is not limited to the following:
  - 1. Installer:
    - a. Before bidding, obtain sponsorship from a local, Approved Distributor specified under PART 2 PRODUCTS of this specification. Initial requirements for sponsorship are:
      - 1) Receive product training from Approved Distributor.
      - 2) Installer to provide Distributor sponsorship by submitting 'Certificate of Sponsorship' as Informational Submittal with bid. Certificate available as Attachment in this Specification.

**PART 2 - PRODUCTS****2.1 SYSTEMS****A. Manufacturers:****1. Manufacturer Contact List:**

- a. Air Products & Controls Ltd, Pontiac, MI [www.ap-c.com](http://www.ap-c.com).
- b. Fire-Lite Alarms, Northford, CT [www.firelite.com](http://www.firelite.com).
- c. Honeywell Inc, Minneapolis, MN [www.honeywell.com](http://www.honeywell.com).
  - 1) Primary Contact: Chris Brinkerhoff, (801) 550-3344, [chris.brinkerhoff@honeywell.com](mailto:chris.brinkerhoff@honeywell.com).
- d. ICCA Firex, Carol Stream, IL [www.icca.invensys.com](http://www.icca.invensys.com).
- e. Insul\_Guard, Salt Lake City, UT:
  - 1) Primary Contact: Dan Craner, (801) 518-3733, [insul\\_guard@comcast.net](mailto:insul_guard@comcast.net).
- f. System Sensor, St Charles, IL [www.systemsensor.com](http://www.systemsensor.com).
- g. Zimmerman Technologies, Renton, WA:
  - 1) Primary Contact: Tracy Zimmerman, (425) 255-1906, [zimmtech@yahoo.com](mailto:zimmtech@yahoo.com).

**B. Distributors: Obtain RP panels, thermostats, and other control equipment from following Sponsoring Approved Distributors. See Section 01 4301:****1. Utah:**

- a. Control Equipment Co: (800) 452-1457 [rhowe@controlequiputah.com](mailto:rhowe@controlequiputah.com) Ray Howe.
- b. Relevant Solutions LLC: (801) 214-3313 [Kathy.Wright@relevantsolutions.com](mailto:Kathy.Wright@relevantsolutions.com) Kathy Wright.

**C. Performance:****1. Design Criteria:**

- a. Automatic Temperature Control System design concept utilizes communicating thermostats located near furnace, with electronic sensors and electric / electronic, actuation of dampers and with thermostats connected with Echleon approved communication cable. A WebStat Building Manager will interface with the thermostats to provide access via internet browse.
- b. Network communications and control devices will be LonWorks compliant. System shall include HVAC control, WebStat Building Manager to provide maintenance management functions related to normal building operations.

**D. Components:****1. Thermostats And Sensors:****a. Thermostat and Sensor Kit:**

- 1) Category Four Approved Product. See Section 01 6200 for definitions of Categories:
  - a) Part Number Y7335H1009 consisting of following:
    - (1) Communicating Thermostat: Low voltage type provided with automatic change-over feature for both heating and cooling stages, seven-day / 365 day program with two starts and stops per day, and provisions for damper operators. Honeywell T7350H1009.
    - (2) Push-Button Remote Room Sensor: Honeywell T7771A1005 with three push buttons, OVERRIDE, WARMER, COOLING, and with selectable ohm resistance, 10k or 20k.
    - (3) Discharge Air Sensor: Honeywell C7041B2005, 6 inch.
  - b) Wall Cover Plate: Honeywell THP2400A1027W.

**2. Sealant Compound:****a. Description:**

- 1) Non hardening waterproof, vapor proof, self-adhesive for hot or cold application for sealing conduit openings against drafts, dust moisture and noise.

**b. Category Four Approved Product. See Section 01 6200 for definitions of Categories:**

- 1) Duct Seal Compound No. DS-130 by Gardner Bender, Menomonee Falls , WI. [www.gardnerbender.com](http://www.gardnerbender.com).
- 2) Thumb-Tite Sealing Compound No. 4216-92 by Nu-Calgon, St. Louis, MO [www.nucalgon.com](http://www.nucalgon.com).

**3. Transformer:**

- a. 120 / 24 V, 50VA Honeywell AT150F.
- b. 120 / 24 V, 75VA Honeywell AT175F.

4. Damper Actuators:
  - a. Electric type equipped for Class I wiring.
  - b. Shall not consume power during Unoccupied cycle or use chemicals or expandable media.
  - c. Have built in spring return.
  - d. Category Four Approved Product. See Section 01 6200 for definitions of Categories:
    - 1) Honeywell MS8105A1030/U.
    - 2) Honeywell MS8105A1130 w/ End switch.
5. Conductors:
  - a. Color-coded and No. 16 and No. 12 AWG Type TWN, TFN, or THHN, stranded.
  - b. Thermostat Cable: 12, 8, or 4 conductor, 18AWG solid copper wire, insulated with high-density polyethylene. Conductors parallel enclosed in brown PVC jacket (22 AWG cable not allowed).
  - c. Communicating Cable:
    - 1) Class Two Quality Standard. See Section 01 6200:
      - a) CAT 4, 22 gauge (0.025 in), twisted pair, non-plenum and non-shielded cable.
- E. Operation Sequences:
  1. Programmable thermostat shall control unoccupied and occupied status of fan system based on adjustable seven day program and remote room sensor / push button. Fan shall run continuously in occupied mode and cycle in unoccupied mode.
  2. Adjustable heating and cooling set points shall control space temperature by activating either heating or cooling equipment. Programmable thermostat provides automatic change over between heating and cooling.
  3. Remote room sensor provides optional override of thermostat program by allowing three hour timed override of thermostat program at any time by pushing ON / OFF button on remote room sensor cover. This shall activate thermostat to occupied mode and system shall control to occupied set point.
  4. Minimum outside air damper, spring return type, shall open in occupied mode and remain closed in unoccupied mode in zones using outside air.

## **PART 3 - EXECUTION**

### **3.1 INSTALLERS**

- A. Acceptable Installers. See Section 01 4301:
  1. Approved HVAC Sub-Contractors shall be pre-approved and included in Construction Documents by Addendum.

### **3.2 INSTALLATION**

- A. Interface With Other Work:
  1. Calibrate room thermostats as required during air test and balance. Insulate sensor J-box with fiberglass insulation; expandable/ foam insulation is NOT acceptable.
  2. Instruct air test and balance personnel in proper use and setting of control system components.
  3. Install low voltage electrical wiring in accordance with Division 26 of these Specifications.
- B. Safety Controls:
  1. Interlock main return air duct smoke detectors to keep heating, cooling, and system fan from operating when detector is energized. Interlock smoke detector for combination fire / smoke dampers so fire / smoke damper closes on detection of smoke.
  2. Outside air dampers shall close on fan shut-down, power failure, open fan motor disconnect switch, and when thermostat is in Unoccupied Mode.
- C. Mount damper actuators and actuator linkages external of airflow. Make certain dampers operate freely without binding or with actuator housing moving.
- D. Paste copy of record control wiring diagram on back of relay panel door cover for each multiple furnace system.

### 3.3 FIELD QUALITY CONTROL

- A. Field Tests:
1. Calibrate, adjust, and set controls for proper operation, operate systems, and be prepared to prove operation of any part of control system. This work is to be completed before pre-substantial completion inspection.
  2. Test each individual heating, cooling, and damper control for proper operation using control system.

### 3.4 CLOSEOUT ACTIVITIES

- A. Instruction Of Owner:
1. Include as part of training required in Section 23 0501, following training:
    - a. Training shall be by personnel of installing company and utilize operator's manuals and as-built documentation.
    - b. Training shall include sequence of operation review, selection of displays, modification of schedules and setpoints, troubleshooting of sensors, etc, as follows:
      - 1) Control System Overview:
        - a) Show access to system through both individual thermostats and Webstat and how network works. Scheduling building at minimum for Stake and General Conference, special events.
      - 2) Thermostat Programming from Keypad and USB memory stick: Instructions on developing setpoints and schedules and adjusting local zone temperatures.
      - 3) Thermostat Operation:
        - a) Identify and explain security settings and screen lockouts.

**END OF SECTION**

**ATTACHMENTS**

**CERTIFICATE OF SPONSORSHIP**  
**Electric and Electronic Control System for HVAC Installer**

**PROJECT INFORMATION** (To be filled out by Installer - available from project specification):

Project Name: \_\_\_\_\_

Project Number: \_\_\_\_\_

Project Address: \_\_\_\_\_

**INSTALLER INFORMATION** (To be filled out by Installer):

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

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

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

I acknowledge and confirm the above listed Installer has received training and exhibit RedLINK/Commercial System skills and is qualified to install the automation control system as specified for Project identified above. Our company will stand behind the Installer meeting the legal specified performance requirements.

Sponsoring Approved Honeywell Distributor Name: \_\_\_\_\_

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

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

**SECTION 23 1123****FACILITY NATURAL-GAS PIPING****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Perform excavation and backfill required for work of this Section.
  - 2. Furnish and install gas piping and fittings within building and from building to meter including connection to meter as described in Contract Documents.
- B. Related Requirements:
  - 1. Sections Under 09 9000 Heading: 'Paints And Coatings' for painting of exterior piping.
  - 2. Section 23 0501: 'Common HVAC Requirements'.
  - 3. Section 23 0553: 'Identification for HVAC Piping and Equipment'.

**1.2 REFERENCES**

- A. Reference Standards:
  - 1. American National Standards Institute / CSA Group:
    - a. ANSI LC 4-2012 (2017) / CSA 6.32-2012 (R2016), 'Press-Connect Metallic Fittings for Use in Fuel Gas Distribution Systems'.
  - 2. ASTM International:
    - a. ASTM A53/A53M-12, 'Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless'.
    - b. ASTM A234/A234M-16, 'Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service'.
    - c. ASTM D2513-16a, 'Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings'.
  - 3. International Code Council (ICC):
    - a. ICC IFGC-2015: 'International Fuel Gas Code'.

**1.3 QUALITY ASSURANCE**

- A. Regulatory Agency Sustainability Approvals:
  - 1. Conform to requirements of requirements of IFGC International Fuel Gas Code.
  - 2. Viega MegaPressG fittings:
    - a. Conform to requirements of Canadian Standards Association CSA B149.1 and to requirements of IFGC International Fuel Gas Code.
- B. Qualifications:
  - 1. Welders:
    - a. Welders shall be certified and bear evidence of certification thirty (30) days before commencing work on project.
    - b. If there is doubt as to proficiency of welder, Owner's Representative may require welder to take another test. This shall be done at no cost to Owner. Certification shall be by Pittsburgh Testing Laboratories or other approved authority.
  - 2. Pipe Installers:
    - a. Polyethylene pipe installers shall be properly trained and certified in procedure for joining polyethylene pipe.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Storage And Handling Requirements:
  - 1. Do not store polyethylene pipe so it is exposed to sunlight.

## PART 2 - PRODUCTS

### 2.1 SYSTEM

#### A. Manufacturers:

1. Manufacturer Contact List:
  - a. BrassCraft, Novi, MI [www.brasscraft.com](http://www.brasscraft.com).
  - b. Cimberio Valve Co Inc, Malvern, PA [www.cimberio.com](http://www.cimberio.com).
  - c. ConBraCo Industries, Inc, Matthews, NC [www.conbraco.com](http://www.conbraco.com) or ConBraCo / Honeywell Ltd, Scarborough, ON (416) 293-8111.
  - d. Dormont Manufacturing Company, Export, PA [www.dormont.com](http://www.dormont.com).
  - e. Jenkins-NH-Canada, Brantford, ON [www.jenkins-nh-canada.com](http://www.jenkins-nh-canada.com).
  - f. Jomar International, Madison Heights, MI [www.jomar.com](http://www.jomar.com).
  - g. California Valves (formally KOSO) by Pacific Seismic Products Inc, Lancaster, CA, Distributed by Strand Earthquake Consultants [www.strandearthquake.net](http://www.strandearthquake.net).
  - h. Viega LLC, Broomfield, CO [www.viega.com](http://www.viega.com).
  - i. Watts Regulator Co, North Andover, MA [www.wattsreg.com](http://www.wattsreg.com) or Watts Industries (Canada) Inc, Burlington, ON (888) 208-8927.

#### B. Materials:

1. Above-Ground Pipe:
  - a. Black carbon steel, butt welded, Schedule 40 pipe meeting requirements of A53/A53M.
2. Above-Ground Pipe Fittings:
  - a. Welded forged steel fittings meeting requirements of ASTM A234/A234M.
  - b. Standard weight malleable iron screwed.
  - c. Viega MegaPressG fittings.
3. Valves:
  - a. 125 psi bronze body ball valve, UL listed.
  - b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - 1) CIM 102.1 by Cimbrio Valve.
    - 2) Apollo Series 80-100 by ConBraCo.
    - 3) 'Red Cap' R602 by Jenkins NH Canada.
    - 4) Model T-204 by Jomar International.
    - 5) Model B-6000-UL by Watts Regulator.
4. Flexible Connector:
  - a. Type 304 stainless steel corrugated tube coated for corrosion protection.
  - b. Maximum pressure drop less than 0.5" w.g.
  - c. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - 1) Dormont Supr-Safe.
    - 2) BrassCraft Procoat.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Steel pipe installed through air plenums, in walls:
  1. Pipes 2-1/2 inches and larger shall have welded fittings and joints.
  2. Other steel pipe may have screwed or welded fittings.
  3. Viega MegaPressG:
    - a. Install MegaPressG fittings according to Manufacture's recommendations and with Manufacture's recommended tools.
- B. After gas meter, valves, seismic valve and etc, gas piping should rise inside outside wall and not be visible to public.
- C. On lines serving gas-fired equipment, install gas cocks adjacent to equipment outside of equipment cabinet and easily accessible.

- D. Install 6 inch long minimum dirt leg, with pipe cap, on vertical gas drop serving each gas-fired equipment unit.
- E. Use fittings for changes of direction in pipe and for branch runouts.
- F. Visible gas piping inside building shall be painted yellow and labeled.
- G. Install seismic valve in 24 inch long pipe section anchored to building wall at each end.

### **3.2 FIELD QUALITY CONTROL**

- A. Field tests:
  - 1. Subject all portions of gas piping system, in sections or in entirety, to air pressure of 75 psig and prove airtight for four (4) hours.
  - 2. Disconnect equipment not suitable for 75 psig pressure from piping system during test period.

**END OF SECTION**



**SECTION 23 2300****REFRIGERANT PIPING****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install piping and specialties for refrigeration systems as described in Contract Documents.
- B. Related Requirements:
  - 1. Section 23 0501: 'Common HVAC Requirements'.
  - 2. Section 23 0719: 'Refrigerant Piping Insulation'.
  - 3. Section 23 6214: 'Compressor Units: Air Conditioning (5 Ton or less)'.

**1.2 REFERENCES**

- A. Association Publications:
  - 1. Federal Emergency Management Agency (FEMA) / Vibration Isolation and Seismic Control Manufacturers Association (VISCMA) / American Society of Civil Engineers (ASCE):
    - a. FEMA 412, 'Installing Seismic Restraints For Mechanical Equipment' (December 2002).
  - 2. Vibration Isolation and Seismic Control Manufacturers Association (VISCMA):
    - a. VISCMA 101-15, 'Seismic Restraint Specification Guidelines for Mechanical, Electrical, and Plumbing Systems'.
    - b. VISCMA 102-12, 'Vibration Isolation Specification Guidelines for Mechanical, Electrical, and Plumbing Systems'.
- B. Definitions:
  - 1. Refrigerant: Absorbs heat by a change of state (evaporation) from liquid to a gas, and releases heat by a change of state (condenses) from gas back to a liquid.
  - 2. Vibration Isolation: Vibration reduction in which an isolation system is placed between the source of unwanted vibration and an item which needs to be shielded from the vibration.
- C. Reference Standards:
  - 1. American National Standards Institute (ANSI) / American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
    - a. ANSI/ASHRAE 5-2013 (packaged w/ 34-2013, 'Safety Standard and Designation and Classification of Refrigerants'.
  - 2. American National Standards Institute / American Welding Society:
    - a. ANSI/AWS A5.8M/A5.8-2011, 'Specification for Filler Metals for Brazing and Braze Welding'.
  - 3. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
    - a. 2011 ASHRAE Handbook - HVAC Applications.
      - 1) Chapter 48, 'Noise and Vibration Control'.
  - 4. ASTM International:
    - a. ASTM A36/A36M-14, 'Standard Specification for Carbon Structural Steel'.
    - b. ASTM B280-13, 'Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service'.
  - 5. National Fire Protection Association / American National Standards Institute:
    - a. NFPA 90A-2015, 'Installation of Air Conditioning and Ventilating Systems'.
  - 6. Underwriters Laboratories:
    - a. UL 2182, 'Refrigerants' (April 2006).

**1.3 SUBMITTALS**

- A. Action Submittals:

1. Shop Drawings: Show each individual equipment and piping support.

B. Informational Submittals:

1. Qualification Statements: Technician certificate for use of HFC and HCFC refrigerants.

## 1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:

1. Refrigerants:
  - a. Underwriters Laboratories / Underwriters Laboratories of Canada:
    - 1) Comply with requirements of UL 2182.

B. Qualifications. Section 01 4301 applies, but is not limited to the following:

1. Installer: Refrigerant piping shall be installed by refrigeration contractor licensed by State and by technicians certified in use of HFC and HCFC refrigerants.

## PART 2 - PRODUCTS

### 2.1 COMPONENTS

A. Manufacturers:

1. Manufacturer Contact List:
  - a. Airtec, Fall River, MA, [www.noventcaps.com](http://www.noventcaps.com).
  - b. Cooper Industries, Houston, TX [www.cooperindustries.com](http://www.cooperindustries.com).
  - c. Cush-A-Clamp by ZSI Manufacturing, Canton, MI [www.cushaclamp.com](http://www.cushaclamp.com).
  - d. Elkhart Products Corp, Elkhart, IN [www.elkhartproducts.com](http://www.elkhartproducts.com).
  - e. Emerson Climate Technologies, St Louis, MO [www.emersonflowcontrols.com](http://www.emersonflowcontrols.com).
  - f. Handy & Harman Products Division, Fairfield, CT [www.handy-1.com](http://www.handy-1.com).
  - g. Harris Products Group, Cincinnati, OH [www.harrisproductsgroup.com](http://www.harrisproductsgroup.com).
  - h. Henry Valve Co, Melrose Park, IL [www.henrytech.com](http://www.henrytech.com).
  - i. Hilti Inc, Tulsa, OK [www.hilti.com](http://www.hilti.com).
  - j. Hydra-Zorb Co, Auburn Hills, MI [www.hydra-zorb.com](http://www.hydra-zorb.com).
  - k. JB Industries, Aurora, IL [www.jbind.com](http://www.jbind.com).
  - l. Mueller Steam Specialty, St Pauls, NC [www.muellersteam.com](http://www.muellersteam.com).
  - m. Nibco Inc, Elkhart, IN [www.nibco.com](http://www.nibco.com).
  - n. Packless Industries, Waco, TX [www.packless.com](http://www.packless.com).
  - o. Parker Corp, Cleveland, OH [www.parker.com](http://www.parker.com).
  - p. Sporlan Valve Co, Washington, MO [www.sporlan.com](http://www.sporlan.com).
  - q. Sherwood Valves, Washington, PA [www.sherwoodvalve.com](http://www.sherwoodvalve.com).
  - r. Thomas & Betts, Memphis, TN [www.superstrut.com](http://www.superstrut.com).
  - s. Unistrut, Div of Atkore International, Inc., Harvey, IL [www.unistrut.com](http://www.unistrut.com).
  - t. Universal Metal Hose, Chicago, IL [www.universalmetalhose.com](http://www.universalmetalhose.com).
  - u. Vibration Mountings & Controls, Bloomingdale, NJ [www.vmc-kdc.com](http://www.vmc-kdc.com).
  - v. Virginia KMP Corp, Dallas, TX [www.virginiakmp.com](http://www.virginiakmp.com).

B. Materials:

1. Refrigerant Piping:
  - a. Meet requirements of ASTM B280, hard drawn straight lengths. Soft copper tubing not permitted.
  - b. Do not use pre-charged refrigerant lines.
2. Refrigerant Fittings:
  - a. Wrought copper with long radius elbows.
  - b. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
    - 1) Mueller Streamline.
    - 2) Nibco Inc.
    - 3) Elkhart.
3. Suction Line Traps:
  - a. Manufactured standard one-piece traps.

- b. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
      - 1) Mueller Streamline.
      - 2) Nibco Inc.
      - 3) Elkhart.
- 4. Tee Access:
  - a. Brass:
    - 1) Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
      - a) JB Industries: Part #A3 Series with Factory Cap and Valve Core.
- 5. Connection Material:
  - a. Brazing Rods in accordance with ANSI/AWS A5.8M/A5.8:
    - 1) Copper to Copper Connections:
      - a) Classification BCuP-4 Copper Phosphorus (6 percent silver).
      - b) Classification BCuP-5 Copper Phosphorus (15 percent silver).
    - 2) Copper to Brass or Copper to Steel Connections: Classification BAg-5 Silver (45 percent silver).
    - 3) Do not use rods containing Cadmium.
  - b. Flux:
    - 1) Type Two Acceptable Products:
      - a) Stay-Silv White Brazing Flux by Harris Products Group.
      - b) High quality silver solder flux by Handy & Harmon.
      - c) Equal as approved by Architect before use. See Section 01 6200.
- 6. Valves:
  - a. Expansion Valves For 6 Ton And Larger System Sizes (Expansion valves for 5 ton and under are packaged with DX coil. See Section 23 5417 and Section 23 8216):
    - 1) For pressure type distributors, externally equalized with stainless steel diaphragm, and same refrigerant in thermostatic elements as in system.
    - 2) Size valves to provide full rated capacity of cooling coil served. Coordinate selection with evaporator coil and condensing unit.
    - 3) Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
      - a) Emerson Climate Technologies.
      - b) Henry.
      - c) Mueller.
      - d) Parker.
      - e) Sporlan.
  - b. Manual Refrigerant Shut-Off Valves:
    - 1) Ball valves designed for refrigeration service and full line size.
    - 2) Valve shall have cap seals.
    - 3) Valves with hand wheels are not acceptable.
    - 4) Provide service valve on each liquid and suction line at compressor.
    - 5) If service valves come as integral part of condensing unit, additional service valves shall not be required.
    - 6) Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
      - a) Henry.
      - b) Mueller.
      - c) Sherwood.
      - d) Virginia.
- 7. Filter-Drier:
  - a. On lines 3/4 inch outside diameter and larger, filter-drier shall be replaceable core type with Schraeder type valve.
  - b. On lines smaller than 3/4 inch outside diameter, filter-drier shall be sealed type with brazed end connections.
  - c. Size shall be full line size.
  - d. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
    - 1) Emerson Climate Technologies.
    - 2) Mueller.
    - 3) Parker.

- 4) Sporlan.
- 5) Virginia.
8. Sight Glass:
  - a. Combination moisture and liquid indicator with protection cap.
  - b. Sight glass shall be full line size.
  - c. Sight glass connections and sight glass body shall be solid copper or brass, no copper-coated steel sight glasses allowed.
  - d. Category Four Approved Product. See Section 01 6200 for definitions of Categories:
    - 1) HMI by Emerson Climate Technologies.
9. Flexible Connectors:
  - a. Designed for refrigerant service with bronze seamless corrugated hose and bronze braiding.
  - b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - 1) Vibration Absorber Model VAF by Packless Industries.
    - 2) Vibration Absorbers by Virginia KMP Corp.
    - 3) Anaconda 'Vibration Eliminators' by Universal Metal Hose.
    - 4) Style 'BF' Spring-flex freon connectors by Vibration Mountings.
10. Refrigerant Piping Supports:
  - a. Base, Angles, And Uprights: Steel meeting requirements of ASTM A36.
  - b. Securing Channels:
    - 1) At Free-Standing Pipe Support:
      - a) Class One Quality Standard: P-1000 channels by Unistrut.
      - b) Acceptable Manufacturers: Hilti, Thomas & Betts.
      - c) Equal as approved by Architect before installation. See Section 01 6200.
    - 2) At Wall Support:
      - a) Class One Quality Standard: P-3300 channels by Unistrut.
      - b) Acceptable Manufacturers: Hilti, Thomas & Betts.
      - c) Equal as approved by Architect before installation. See Section 01 6200.
    - 3) At Suspended Support:
      - a) Class One Quality Standard: P-1001 channels by Unistrut.
      - b) Acceptable Manufacturers: Hilti, Thomas & Betts.
      - c) Equal as approved by Architect before installation. See Section 01 6200.
    - 4) Angle Fittings:
      - a) Class One Quality Standard: P-2626 90 degree angle by Unistrut.
      - b) Acceptable Manufacturers: Hilti, Thomas & Betts.
      - c) Equal as approved by Architect before installation. See Section 01 6200.
    - 5) Low-Slope Roof Base Support:
      - a) Class One Quality Standard: Dura-Blok DBE or DB-DS by Cooper B-Line.
      - b) Acceptable Manufacturers: Unistrut, Mirror, and Mifab.
      - c) Equal as approved by Architect before installation. See Section 01 6200.
  - c. Pipe Clamps:
    - 1) Type Two Acceptable Manufacturers:
      - a) Hydra-Zorb.
      - b) ZSI Cush-A-Clamp.
      - c) Hilti Cush-A-Clamp.
      - d) Equal as approved by Architect before installation. See Section 01 6200.
  - d. Protective Cover (Concealed): 18 ga steel, hot-dipped galvanized.
  - e. Polyvinylidene Fluoride (PVF<sub>2</sub>) Resin-base finish (Kynar 500 or Hylar 5000) containing 70 percent minimum PVF<sub>2</sub> in resin portion of formula. Thermos-cured two coat system consisting of corrosion inhibiting epoxy primer and top coat factory applied over properly pre-treated metal. Color as selected by Architecture from Manufacturer's standard colors.
  - f. Protective Cover: 18 GA steel, with polyvinylidene.
11. Locking Refrigerant Cap:
  - a. Provide and install on charging valves:
    - 1) Class One Quality Standard: 'No Vent' locking refrigerant cap.
    - 2) Acceptable Manufacturers: Airtec.
    - 3) Equal as approved by Architect before installation. See Section 01 6200.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Refrigerant Lines:
1. Install as high in upper mechanical areas as possible. Do not install underground or in tunnels.
  2. Slope suction lines down toward compressor one inch/10 feet. Locate traps at vertical rises against flow in suction lines.
- B. Connections:
1. Refrigeration system connections shall be copper-to-copper, copper-to-brass, or copper-to-steel type properly cleaned and brazed with specified rods. Use flux only where necessary. No soft solder (tin, lead, antimony) connections will be allowed in system.
  2. Braze manual refrigerant shut-off valve, sight glass, and flexible connections.
  3. Circulate dry nitrogen through tubes being brazed to eliminate formation of copper oxide during brazing operation.
- C. Specialties:
1. Install valves and specialties in accessible locations. Install refrigeration distributors and suction outlet at same end of coil.
  2. Install thermostatic bulb as close to cooling coil as possible. Do not install on vertical lines.
  3. Install equalizing line in straight section of suction line, downstream of and reasonably close to thermostatic bulb. Do not install on vertical lines.
  4. Provide flexible connectors in each liquid line and suction line at both condensing unit and evaporator on systems larger than five tons. Anchor pipe near each flexible connector.
- D. Refrigerant Supports:
1. Support Spacing:
    - a. Piping 1-1/4 inch And Larger: 8 feet on center maximum.
    - b. Piping 1-1/8 inch And Smaller: 6 feet on center maximum.
    - c. Support each elbow.
  2. Isolate pipe from supports and clamps with Hydrozorb or Cush-A-Clamp systems.
  3. Run protective cover continuous from condensing units to risers or penetrations at building wall.

### **3.2 FIELD QUALITY CONTROL**

- A. Field Tests:
1. Make evacuation and leak tests in presence of Architect's Engineer after completing refrigeration piping systems. Positive pressure test will not suffice for procedure outlined below.
    - a. Draw vacuum on each entire system with two stage vacuum pump. Draw vacuum to 300 microns using micron vacuum gauge capable of reading from atmosphere to 10 microns. Do not use cooling compressor to evacuate system nor operate it while system is under high vacuum.
    - b. Break vacuum with nitrogen and re-establish vacuum test. Vacuum shall hold for 30 minutes at 300 microns without vacuum pump running.
    - c. Conduct tests at 70 deg F ambient temperature minimum.
    - d. Do not run systems until above tests have been made and systems started up as specified. Inform Owner's Representative of status of systems at time of final inspection and schedule start-up and testing if prevented by outdoor conditions before this time.
    - e. After testing, fully charge system with refrigerant and conduct test with Halide Leak Detector.
    - f. Recover all refrigerant in accordance with applicable codes. Do not allow any refrigerant to escape to atmosphere.
- B. Non-Conforming Work:
1. If it is observed that refrigerant lines are being or have been brazed without proper circulation of nitrogen through lines, all refrigerant lines installed up to that point in time shall be removed and replaced at no additional cost to Owner.

**END OF SECTION**

**SECTION 23 2600****CONDENSATE DRAIN PIPING****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Coordinate installation of condensate drain piping with Section 22 0501 as described in Contract Documents.
- B. Related Requirements:
  - 1. Section 22 0501: 'Common Plumbing Requirements'.
  - 2. Section 23 0501: 'Common HVAC Requirements'.

**1.2 REFERENCES**

- A. Reference Standards:
  - 1. ASTM International:
    - a. ASTM B88-09, 'Standard Specification for Seamless Copper Water Tube'.
    - b. ASTM D1785-12, 'Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120'.

**PART 2 - PRODUCTS****2.1 SYSTEMS**

- A. Materials:
  - 1. Condensate Drains:
    - a. Schedule 40 PVC for condensate drains from furnace combustion chambers and furnace cooling coils.
  - 2. Solvent Cement and Adhesive Primer:
    - a. Use PVC solvent cement that has a VOC content of 510 g/L or less if required by local AHJ if required.
    - b. Use adhesive primer that has a VOC content of 550 g/L or less if required by local AHJ if required.

**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. Condensate Drains:
  - 1. Support piping and protect from damage.
  - 2. Do not combine PVC condensate drain piping from furnace combustion chamber with copper condensate drain piping from cooling coil.

**END OF SECTION**

**SECTION 23 3001****COMMON DUCT REQUIREMENTS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. General procedures and requirements for ductwork.
  - 2. Repair leaks in ductwork, as identified by duct testing, at no additional cost to Owner.
- B. Related Requirements:
  - 1. Section 01 4546: 'Duct Testing, Adjusting, and Balancing' for ductwork.
  - 2. Section 07 9219: 'Acoustical Joint Sealants' for quality of acoustic sealant.
  - 3. Section 23 0501: 'Common HVAC Requirements'.

**1.2 REFERENCES**

- A. Reference Standards:
  - 1. Sheet Metal And Air Conditioning Contractors' National Association / American National Standards Institute:
    - a. SMACNA, 'HVAC Duct Construction Standards - Metal and Flexible' (Third Edition).

**1.3 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-Installation Conference: Schedule conference immediately before installation of ductwork.

**1.4 SUBMITTALS**

- A. Action Submittals:
  - 1. Product Data: Specification data on sealer and gauze proposed for sealing ductwork.
  - 2. Samples: Sealer and gauze proposed for sealing ductwork.

**PART 2 - PRODUCTS****2.1 ASSEMBLIES**

- A. Performance:
  - 1. Design Criteria:
    - a. Standard Ducts: Construction details not specifically called out in Contract Documents shall conform to applicable requirements of SMACNA, 'HVAC Duct Construction Standards - Metal and Flexible'.
- B. Materials:
  - 1. Duct Hangers:
    - a. One inch by 18 ga galvanized steel straps or steel rods as shown on Drawings, and spaced not more than 96 inches apart. Do not use wire hangers.
    - b. Attaching screws at trusses shall be 2 inch No. 10 hex head screws. Nails not allowed.
    - c. Attach threaded rod to steel joist with Anvil Steel washer plate Fig. 60. Double nut connection.

**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. During installation, protect open ends of ducts by covering with plastic sheet tied in place to prevent entrance of debris and dirt.
- B. Make necessary allowances and provisions in installation of sheet metal ducts for structural conditions of building. Revisions in layout and configuration may be allowed, with prior written approval of Architect. Maintain required airflows in suggesting revisions.
- C. Hangers And Supports:
  - 1. Install pair of hangers as required by spacing indicated in table on Drawings.
  - 2. Install upper ends of hanger securely to floor or roof construction above by method shown on Drawings.
  - 3. Attach strap hangers to ducts with cadmium-plated screws. Use of pop rivets or other means will not be accepted.
  - 4. Where hangers are secured to forms before concrete slabs are poured, cut off flush all nails, strap ends, and other projections after forms are removed.
  - 5. Secure vertical ducts passing through floors by extending bracing angles to rest firmly on floors without loose blocking or shimming. Support vertical ducts, which do not pass through floors, by using bands bolted to walls, columns, etc. Size, spacing, and method of attachment to vertical ducts shall be same as specified for hanger bands on horizontal ducts.

**3.2 CLEANING**

- A. Clean interior of duct systems before final completion.

**END OF SECTION**



**SECTION 23 3114****LOW-PRESSURE METAL DUCTS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install above-grade low-pressure steel ducts and related items as described in Contract Documents.
- B. Products Installed But Not Furnished Under This Section:
  - 1. Duct smoke detectors.
- C. Related Requirements:
  - 1. Section 01 4546: 'Duct Testing, Adjusting, And Balancing' for duct test, balance, and adjust air duct systems services provided by Owner.
  - 2. Section 23 0713: 'Duct Insulation' for thermal Insulation for ducts, plenum chambers, and casings.
  - 3. Section 23 3001: 'Common Duct Requirements'.
  - 4. Section 23 0933: 'Electric And Electronic Control System For HVAC':
    - a. Temperature control damper actuators and actuator linkages.
    - b. Furnishing of duct smoke detectors.

**1.2 REFERENCES**

- A. Association Publications:
  - 1. Sheet Metal And Air Conditioning Contractors' National Association / American National Standards Institute:
  - 2. SMACNA, 'HVAC Duct Construction Standards - Metal and Flexible' (Third Edition).
  - 3. SMACNA, "IAQ Guidelines for Occupied Buildings Under Construction".
- B. Reference Standards:
  - 1. ASTM International:
    - a. ASTM A653/A653M-13, 'Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process'.
    - b. ASTM E84-14, 'Standard Test Method for Surface Burning Characteristics of Building Materials'.
  - 2. Underwriters Laboratories, Inc.:
    - a. UL 723: 'Standard for Safety Test for Surface Burning Characteristics of Building Materials'; (2010 - Tenth Edition).

**1.3 QUALITY ASSURANCE**

- A. Regulatory Agency Sustainability Approvals:
  - 1. Duct Sealer:
    - a. Meet Class A flame spread rating in accordance with ASTM E84 or UL 723.
    - b. Handle, store, and apply materials in compliance with applicable regulations and material safety data sheets (MSDS).

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Storage and Handling Requirements:
  - 1. Duct Sealer:
    - a. Handle, store, and apply materials in compliance with applicable regulations and material safety data sheets (MSDS).

- b. Handle to prevent inclusion of foreign matter, damage by water, or breakage.
- c. Store in a cool dry location, but never under 35 deg F or subjected to sustained temperatures exceeding 110 deg F or as per Manufacturer's written recommendations.
- d. Do use sealants that have exceeded shelf life of product.

## 1.5 FIELD CONDITIONS

### A. Ambient Conditions:

- 1. Duct Sealer:
  - a. Do not apply under 35 deg F or subjected to sustained temperatures exceeding 110 deg F or as per Manufacturer's written recommendations.
  - b. Do not apply when rain or freezing temperatures will occur within seventy two (72) hours.

## PART 2 - PRODUCTS

### 2.1 SYSTEM

#### A. Materials:

- 1. Sheet Metal:
  - a. Fabricate ducts, plenum chambers and casings of zinc-coated, lock-forming quality steel sheets meeting requirements A653/A653M, with G 60 coating.
- 2. Duct Sealer For Interior Ducts:
  - a. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - 1) Duct Butter or ButterTak by Cain Manufacturing Co Inc, Pelham, AL  
www.cainmfg.com.
    - 2) DP 1010, DP 1030 or DP 1015 by Design Polymerics, Fountain Valley, CA  
www.designpoly.com.
    - 3) PROseal, FIBERseal, EVERseal, or EZ-seal by Ductmate Industries, Inc., Charleroi, PA  
www.ductmate.com.
    - 4) SAS by Duro Dyne, Bay Shore, NY or Duro Dyne Canada, Lachine, QB  
www.durodyne.com.
    - 5) Iron Grip 601 by Hardcast Inc, Wylie, TX www.hardcast.com.
    - 6) MTS100 or MTS 200 by Hercules Mighty Tough, Denver CO,  
www.herculesindustries.com.
    - 7) 15-325 by Miracle / Kingco, Div ITW TACC, Rockland, MA www.taccint.com.
    - 8) 44-39 by Mon-Eco Industries Inc, East Brunswick, NJ www.mon-ecoindustries.com.
    - 9) Airseal Zero by Polymer Adhesive Sealant Systems Inc, Weatherford, TX  
www.polymeradhesives.com.
    - 10) Airseal #22 Water Base Duct Sealer by Polymer Adhesive Sealant Systems Inc,  
Weatherford, TX www.polymeradhesives.com.

#### B. Fabrication:

- 1. General:
  - a. Straight and smooth on inside with joints neatly finished.
  - b. Duct drops to diffusers shall be round, square, or rectangular to accommodate diffuser neck. Drops shall be same gauge as branch duct. Seal joints air tight.
- 2. Standard Ducts:
  - a. General:
    - 1) Ducts shall be large enough to accommodate inside acoustic duct liner. Dimensions shown on Drawings are net clear inside dimensions after duct liner has been installed.
  - b. Rectangular Duct:
    - 1) Duct panels through 48 inch dimension having acoustic duct liner need not be cross-broken or beaded. Cross-break unlined ducts, duct panels larger than 48 inch vertical and horizontal sheet metal barriers, duct offsets, and elbows, or bead 12 inches on center.
      - a) Apply cross-breaking to sheet metal between standing seams or reinforcing angles.
      - b) Center of cross-break shall be of required height to assure surfaces being rigid.
      - c) Internally line square and rectangular drops. Externally insulate round drops.

- 2) Duct with height or width over 36 inches shall be fabricated using SMACNA T-24 flange joints or of pre-fabricated systems as follows:
  - a) Ducts with sides over 36 inches up to 48 inches: Transverse duct joint system by Ductmate / 25, Elgen, Ward, or WDCI (SMACNA Class 'F' joint).
  - b) Ducts 48 inch And Larger: Ductmate / 35, Elgen, or WDCI (SMACNA Class 'J' transverse joint).
  - c) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - (1) Ductmate Industries Inc, Charleroi, PA [www.ductmate.com](http://www.ductmate.com) or Ductmate Canada Ltd, Burlington, ON (905) 332-7678.
    - (2) Ward Industries Inc, Bensonville, IL [www.wardind.com](http://www.wardind.com).
    - (3) Elgen Manufacturing Company, Inc., East Ruterford, NJ [www.elgenmfg.com](http://www.elgenmfg.com).
- c. Round Duct:
  - 1) Spiral Seam:
    - a) 28 ga minimum for ducts up to and including 14 inches in diameter.
    - b) 26 ga minimum for ducts over 14 inches and up to and including 26 inches in diameter.
  - 2) Longitudinal Seam:
    - a) 28 ga minimum for ducts up to and including 8 inches in diameter.
    - b) 26 ga minimum for ducts over 8 inches and up to 14 inches in diameter.
    - c) 24 ga minimum for ducts over 14 inches up to and including 26 inches in diameter.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Metal duct surface must be clean and free of moisture, contamination and foreign matter before applying duct sealer for interior and exterior ducts.

### 3.2 INSTALLATION

- A. Install internal ends of slip joints in direction of flow. Seal transverse and longitudinal joints air tight using specified duct sealer as per Manufacturer's written instructions. Cover horizontal and longitudinal joints on exterior ducts with two layers of specified tape installed with specified adhesive.
- B. Securely anchor ducts and plenums to building structure with specified duct hangers attached with screws. Do not hang more than one duct from a duct hanger. Brace and install ducts so they shall be free of vibration under all conditions of operation.
- C. Ducts shall not bear on top of structural members.
- D. Paint ductwork visible through registers, grilles, and diffusers flat black.
- E. Properly flash where ducts protrude above roof.
- F. Under no conditions will pipes, rods, or wires be allowed to penetrate ducts.
- G. Where ducts are shown connecting to concrete or masonry openings and along edges of plenums at floors and walls, provide continuous 2 by 2 by 1/4 inches galvanized angle iron.
  1. Bolt angle iron to structure and make airtight by applying sealant between angle and structure.
  2. Bolt or weld sheet metal at these locations to angle and caulk airtight.
  3. Apply two coats of aluminum paint to angles after installation.

### 3.3 FIELD QUALITY CONTROL

- A. Field Tests:
  1. Air Test and Balance Testing as specified in Section 01 4546: 'Duct Testing, Adjusting, and Balancing'.

B. Non-Conforming Work:

1. Reseal transverse joint duct leaks and seal longitudinal duct joint leaks discovered during air test and balance procedures at no additional cost to Owner.

**END OF SECTION**

**SECTION 23 3300****AIR DUCT ACCESSORIES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install duct accessories in specified ductwork as described in Contract Documents.
- B. Related Requirements:
  - 1. Section 23 0933: 'Electric And Electronic Control System For HVAC' for temperature control damper actuators and actuator linkages.
  - 2. Section 23 3001: 'Common Duct Requirements'.

**1.2 REFERENCES**

- A. Reference Standards:
  - 1. ASTM International:
    - a. ASTM A653/A653M-15, 'Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process'.
    - b. ASTM C1071-12, 'Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)'.
    - c. ASTM C1338-14, 'Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings'.

**PART 2 - PRODUCTS****2.1 ACCESSORIES**

- A. Manufacturers:
  - 1. Manufacturer Contact List:
    - a. AGM Industries, Brockton, MA [www.agmind.com](http://www.agmind.com).
    - b. Air Balance Inc, Holland, OH [www.airbalance.com](http://www.airbalance.com).
    - c. Air Filters Inc, Baltimore, MD [www.afinc.com](http://www.afinc.com).
    - d. Air-Rite Manufacturing, Bountiful, UT (801) 295-2529.
    - e. American Warming & Ventilating, Holland, OH [www.american-warming.com](http://www.american-warming.com).
    - f. Arrow United Industries, Wyalusing, PA [www.arrowunited.com](http://www.arrowunited.com).
    - g. Cain Manufacturing Company Inc, Pelham, AL [www.cainmfg.com](http://www.cainmfg.com).
    - h. C & S Air Products, Fort Worth, TX [www.csairproducts.com](http://www.csairproducts.com).
    - i. CertainTeed Corp, Valley Forge, PA [www.certainteed.com](http://www.certainteed.com).
    - j. Cesco Products, Florence, KY [www.cescoproducts.com](http://www.cescoproducts.com).
    - k. Daniel Manufacturing, Ogden, UT (801) 622-5924.
    - l. Design Polymerics, Fountain Valley, CA [www.designpoly.com](http://www.designpoly.com).
    - m. Ductmate Industries Inc, East Charleroi, PA [www.ductmate.com](http://www.ductmate.com).
    - n. Duro Dyne, Bay Shore, NY [www.durodyne.com](http://www.durodyne.com).
    - o. Dyn Air Inc. Lachine, QB [www.dynair.ca](http://www.dynair.ca)
    - p. Elgen Manufacturing Company, Inc. East Rutherford, NJ [www.elgenmfg.com](http://www.elgenmfg.com)
    - q. Flexmaster USA Inc, Houston, TX [www.flexmasterusa.com](http://www.flexmasterusa.com).
    - r. Greenheck Corp, Schofield, WI [www.greenheck.com](http://www.greenheck.com).
    - s. Gripnail Corp, East Providence, RI [www.gripnail.com](http://www.gripnail.com).
    - t. Hardcast Inc, Wylie, TX [www.hardcast.com](http://www.hardcast.com).
    - u. Hercules Industries, Denver, CO, [www.herculesindustries.com](http://www.herculesindustries.com).
    - v. Honeywell Inc, Minneapolis, MN [www.honeywell.com](http://www.honeywell.com).
    - w. Industrial Acoustics Co, Bronx, NY [www.industrialacoustics.com](http://www.industrialacoustics.com).
    - x. Johns-Manville, Denver, CO [www.jm.com](http://www.jm.com).

- y. Kees Inc, Elkhart Lake, WI [www.kees.com](http://www.kees.com).
- z. Knauf Fiber Glass, Shelbyville, IN [www.knauffiberglass.com](http://www.knauffiberglass.com).
- aa. Manson Insulation Inc, Brossard, QB [www.isolationmanson.com](http://www.isolationmanson.com).
- bb. Metco Inc, Salt Lake City, UT (801) 467-1572 [www.metcospiral.com](http://www.metcospiral.com).
- cc. Miracle / Kingco, Rockland, MA [www.taccint.com](http://www.taccint.com).
- dd. Mon-Eco Industries Inc, East Brunswick, NJ [www.mon-ecoindustries.com](http://www.mon-ecoindustries.com).
- ee. Nailor Industries Inc, Houston, TX [www.nailor.com](http://www.nailor.com).
- ff. Owens Corning, Toledo, OH [www.owenscorning.com](http://www.owenscorning.com).
- gg. Polymer Adhesive Sealant Systems Inc, Irving, TX [www.polymeradhesives.com](http://www.polymeradhesives.com).
- hh. Pottorff Company, Fort Worth, TX [www.pottorff.com](http://www.pottorff.com).
- ii. Ruskin Manufacturing, Kansas City, MO [www.ruskin.com](http://www.ruskin.com).
- jj. Sheet Metal Connectors Inc, Minneapolis, MN [www.smconnectors.com](http://www.smconnectors.com).
- kk. Tamco, Stittsville, ON [www.tamco.ca](http://www.tamco.ca).
- ll. Techno Adhesive, Cincinnati, OH [www.technoadhesives.com](http://www.technoadhesives.com).
- mm. Titus, Richardson, TX (972) 699-1030. [www.titus-hvac.com](http://www.titus-hvac.com)
- nn. McGill AirSeal, Columbus, OH [www.mcgillairseal.com](http://www.mcgillairseal.com).
- oo. United Enertech Corp, Chattanooga, TN [www.unitedenertech.com](http://www.unitedenertech.com).
- pp. Utemp Inc, Salt Lake City, UT (801) 978-9265.
- qq. Ventfabrics Inc, Chicago, IL [www.ventfabrics.com](http://www.ventfabrics.com).
- rr. Ward Industries, Grand Rapids MI [www.wardind.com](http://www.wardind.com).
- ss. Young Regulator Co, Cleveland, OH [www.youngregulator.com](http://www.youngregulator.com).

B. Materials:

1. Acoustical Liner System:

a. Duct Liner:

- 1) One inch thick, 1-1/2 lb density fiberglass conforming to requirements of ASTM C1071. Liner will not support microbial growth when tested in accordance with ASTM C1338.
- 2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
  - a) ToughGard by CertainTeed.
  - b) Duct Liner E-M by Knauf Fiber Glass.
  - c) Akousti-Liner by Manson Insulation.
  - d) Quiet R by Owens Corning.
  - e) Linacoustic RC by Johns-Manville.

b. Adhesive:

- 1) Category Four Approved Water-Based Products. See Section 01 6200 for definitions of Categories:
  - a) Cain: Hydrotak.
  - b) Design Polymerics: DP2501 or DP2502 (CMCL-2501).
  - c) Duro Dyne: WSA.
  - d) Elgen: A-410-WB.
  - e) Hardcast: Coil-Tack.
  - f) Hercules: Mighty Tough Adhesives MTA500 or MTA600.
  - g) Miracle / Kingco: PF-101.
  - h) Mon-Eco: 22-67 or 22-76.
  - i) Polymer Adhesive: Glasstack #35.
  - j) Techno Adhesive: 133.
  - k) McGill AirSeal: Uni-tack.
- 2) Category Four Approved Solvent-Based (non-flammable) Products. See Section 01 6200 for definitions of Categories:
  - a) Cain: Safetak.
  - b) Duro Dyne: FPG.
  - c) Hardcast: Glas-Grip 648-NFSE.
  - d) Miracle / Kingco: PF-91.
  - e) Mon-Eco: 22-24.
  - f) Polymer Adhesive: Q-Tack.
  - g) Techno Adhesive: 'Non-Flam' 106.
- 3) Category Four Approved Solvent-Based (flammable) Products. See Section 01 6200 for definitions of Categories:
  - a) Cain: HV200.

- b) Duro Dyne: MPG.
- c) Hardcast: Glas-Grip 636-SE.
- d) Miracle / Kingco: PF-96.
- e) Mon-Eco: 22-22.
- f) Polymer Adhesive: R-Tack.
- g) Techno Adhesive: 'Flammable' 106.
- c. Fasteners:
  - 1) Adhesively secured fasteners not allowed.
  - 2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - a) AGM Industries: 'DynaPoint' Series RP-9 pin.
    - b) Cain.
    - c) Duro Dyne.
    - d) Gripnail: May be used if each nail is installed by 'Grip Nail Air Hammer' or by 'Automatic Fastener Equipment' in accordance with Manufacturer's recommendations.
- 2. Flexible Equipment Connections:
  - a. 30 oz closely woven UL approved glass fabric, double coated with neoprene.
  - b. Fire retardant, waterproof, air-tight, resistant to acids and grease, and withstand constant temperatures of 200 deg F.
  - c. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - 1) Cain: N-100.
    - 2) Duro Dyne: MFN.
    - 3) Dyn Air: CPN with G-90 galvanized off-set seam.
    - 4) Elgen: ZLN / SDN.
    - 5) Ventfabrics: Ventglas.
    - 6) Ductmate: ProFlex.
- 3. Duct Access Doors:
  - a. General:
    - 1) Factory built insulated access door with hinges and sash locks, as necessary. Construction shall be galvanized sheet metal, 24 ga minimum.
    - 2) Fire and smoke damper access doors shall have minimum clear opening of 12 inches square or larger as shown on Drawings.
  - b. Rectangular Ducts:
    - 1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - a) Air Balance: Fire/Seal FSA 100.
      - b) Air-Rite: Model HAD-2.
      - c) Cesco: HDD.
      - d) Elgen: TAB Type / Hinge and Cam.
      - e) Flexmaster: Spin Door.
      - f) Kees: ADH-D.
      - g) Nailor: 08SH.
      - h) Pottorff: 60-HAD.
      - i) Ruskin: ADH-24.
      - j) United Enertech: L-95.
  - c. Round Ducts:
    - 1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - a) Ductmate: 'Sandwich' Access Door.
      - b) Elgen: Sandwich Access Door.
      - c) Kees: ADL-R.
      - d) Nailor: 0809.
      - e) Pottorff: RAD.
      - f) Ruskin: ADR.
      - g) Ward: DSA.
- 4. Dampers And Damper Accessories:
  - a. Locking Quadrant Damper Regulators:
    - 1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - a) Duro Dyne: KS-385.
      - b) Dyn Air: QPS-385.
      - c) Elgen: EQR-4.

- d) Ventfabrics: Ventline 555.
- e) Young: No. 1.
- b. Concealed Ceiling Damper Regulators:
  - 1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - a) Cain.
    - b) Duro Dyne.
    - c) Elgen.
    - d) Metco Inc.
    - e) Ventfabrics: 666 Ventlok.
    - f) Young: 301.
- c. Volume Dampers:
  - 1) Rectangular Duct:
    - a) Factory-manufactured 16 ga galvanized steel, single blade and opposed blade type with 3/8 inch axles and end bearings. Blade width 8 inches maximum. Blades shall have 1/8 inch clearance all around.
    - b) Damper shall operate within acoustical duct liner.
    - c) Provide channel spacer equal to thickness of duct liner.
    - d) Dampers above removable ceiling and in Mechanical Rooms shall have locking quadrant on bottom or side of duct. Otherwise, furnish with concealed ceiling damper regulator and cover plate.
    - e) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - (1) Air-Rite: Model CD-2.
      - (2) American Warming: VC-2-AA.
      - (3) Arrow: OBDAF-207.
      - (4) C & S: AC40.
      - (5) Cesco: AGO.
      - (6) Daniel: CD-OB.
      - (7) Greenheck: VCD-20.
      - (8) Nailor: 1810 or 1820.
      - (9) Pottorff: CD-42.
      - (10) Ruskin: MD-35.
      - (11) United Enertech: MD-115.
      - (12) Utemp: CD-OB.
  - 2) Round Duct:
    - a) Factory-manufactured 20 ga galvanized steel, single blade with 3/8 inch axles and end bearings.
    - b) For use in outside air ducts.
    - c) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - (1) Air Balance: Model AC-22.
      - (2) Air-Rite: Model CD-8.
      - (3) American Warming: V-22.
      - (4) Arrow: Type-70.
      - (5) C & S: AC21R.
      - (6) Cesco: MGG.
      - (7) Nailor: 1890.
      - (8) Pottorff: CD-21R.
      - (9) Ruskin: MDRS-25.
      - (10) United Enertech: RD.
- d. Motorized Outside Air Dampers:
  - 1) General:
    - a) Low leakage type. AMCA certified.
    - b) Make provision for damper actuators and actuator linkages to be mounted external of air flow.
  - 2) Rectangular Ducts:
    - a) Damper Blades:
      - (1) Steel or aluminum airfoil type with mechanically locked blade seals, 8 inch blade width maximum measured perpendicular to axis of damper.



- (2) Jamb seals shall be flexible metal compression type.
- (3) Opposed or single blade type.
- b) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
  - (1) Air Balance: AC 526.
  - (2) American Warming: AC526.
  - (3) Arrow: AFD-20.
  - (4) C & S: AC50.
  - (5) Cesco: AGO3.
  - (6) Nailor: 2020.
  - (7) Pottorff: CD-52.
  - (8) Ruskin: CD-60.
  - (9) Tamco: Series 1000.
  - (10) United Enertech: CD-150 or CD-160.
- 3) Round Ducts:
  - a) Damper Blades:
    - (1) Steel with mechanically locked blade seals.
    - (2) Blade seals shall be neoprene or polyethylene.
    - (3) Single blade type.
  - b) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - (1) Air Balance: AC 25.
    - (2) American Warming: VC25.
    - (3) Arrow: Type 70 or 75.
    - (4) C & S: AC25R.
    - (5) Cesco: AGG.
    - (6) Nailor: 1090.
    - (7) Pottorff: CD-25R.
    - (8) Ruskin: CD25.
    - (9) Tamco: Square-to-Round Series 1000.
    - (10) United Enertech: RI.
- 5. Air Turns:
  - a. Single thickness vanes. Double thickness vanes not acceptable.
  - b. 4-1/2 inch wide vane rail. Junior vane rail not acceptable.
- 6. Branch Tap for Round or Flexible Ductwork:
  - a. Factory-manufactured rectangular-to-round 45 degree leading tap fabricated of 24 ga zinc-coated lock-forming quality steel sheets meeting requirements of ASTM A653, with G-90 coating.
  - b. One inch wide mounting flange with die formed corner clips, pre-punched mounting holes, and adhesive coated gasket.
  - c. Manual Volume Damper:
    - 1) Single blade, 22 ga minimum
    - 2) 3/8 inch minimum square rod with brass damper bearings at each end.
    - 3) Heavy-duty locking quadrant on 1-1/2 inch high stand-off mounting bracket attached to side of round duct.
  - d. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - 1) ST-1HD by Air-Rite:
      - a) Nylon damper bearings approved for Air-Rite.
    - 2) STO by Flexmaster.
    - 3) HET by Sheet Metal Connectors.
- C. Fabrication:
  - 1. Duct Liner:
    - a. Install mat finish surface on airstream side. Secure insulation to cleaned sheet metal duct with continuous 100 percent coat of adhesive and with 3/4 inch long mechanical fasteners 12 inches on center maximum unless detailed otherwise on Drawings. Pin all duct liner.
    - b. Accurately cut liner and thoroughly coat ends with adhesive. Butt joints tightly. Top and bottom sections of insulation shall overlap sides. If liner is all one piece, folded corners shall be tight against metal. Ends shall butt tightly together.

- c. Coat longitudinal and transverse edges of liner with adhesive.
2. Air Turns:
  - a. Permanently install vanes arranged to permit air to make abrupt turn without appreciable turbulence, in 90 degree elbows of above ground supply and return ductwork.
  - b. Quiet and free from vibration when system is in operation.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Duct Liner:
  1. Furnish and install acoustic lining in following types of rectangular ducts unless noted otherwise on Contract Documents:
    - a. Supply air.
    - b. Return air.
    - c. Mixed air.
    - d. Transfer air.
    - e. Relief air.
    - f. Exhaust air.
    - g. Elbows, fittings, and diffuser drops greater than 12 inches in length.
    - h. Concrete underfloor boxes.
  2. Do not install acoustic lining in round ducts.
- B. Flexible Connections: Install flexible inlet and outlet duct connections to each furnace, fan coil or air handler.
- C. Access Doors In Ducts:
  1. Install at each manual outside air damper and at each motorized damper. Locate doors within 6 inches of installed dampers.
  2. Install within 6 inches of fire dampers and in Mechanical Room if possible. Install on side of duct that allows easiest access to damper.
- D. Dampers And Damper Accessories:
  1. Install concealed ceiling damper regulators.
    - a. Paint cover plates to match ceiling tile.
    - b. Do not install damper regulators for dampers located directly above removable ceilings or in Mechanical Rooms.
  2. Provide each take-off with an adjustable volume damper to balance that branch.
    - a. Anchor dampers securely to duct.
    - b. Install dampers in main ducts within insulation.
    - c. Dampers in branch ducts shall fit against sheet metal walls, bottom and top of duct, and be securely fastened. Cut duct liner to allow damper to fit against sheet metal.
    - d. Where concealed ceiling damper regulators are installed, provide cover plate.
  3. Install motorized dampers.

**END OF SECTION**

**SECTION 23 3346****FLEXIBLE DUCTS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install supply air branch duct runouts to diffusers as described in Contract Documents.
- B. Related Requirements:
  - 1. Section 23 3001: Common Duct Requirements.

**1.2 REFERENCES**

- A. Reference Standards:
  - 1. National Fire Protection Association / American National Standards Institute:
    - a. NFPA 90A: 'Standard for the Installation of Air-Conditioning and Ventilating Systems' (2012 Edition).
  - 2. Underwriters Laboratories:
    - a. UL 181, 'Factory-Made Ducts and Air Connectors' (10th Edition).
    - b. UL 181B, 'Closure Systems for Use With Flexible Air Ducts and Air Connectors' (3rd Edition).

**PART 2 - PRODUCTS****2.1 SYSTEM**

- A. Manufacturers:
  - 1. Manufacturer Contact List:
    - a. JP Lamborn Co., Fresno CA [www.jpflex.com](http://www.jpflex.com).
    - b. Flexmaster USA Inc, Houston, TX [www.flexmasterusa.com](http://www.flexmasterusa.com) or Flexmaster Canada Ltd, Richmond Hill, ON (905) 731-9411.
    - c. Thermaflex by Flexible Technologies, Abbeville, SC or Mississauga, ON [www.thermaflex.net](http://www.thermaflex.net).
- B. Materials:
  - 1. Ducts:
    - a. Formable, flexible, circular duct which shall retain its cross-section, shape, rigidity, and shall not restrict airflow after bending.
    - b. Insulation:
      - 1) Nominal 1-1/2 inches, 3/4 lb per cu ft density fiberglass insulation with air-tight, polyethylene or polyester core, sheathed in seamless vapor barrier jacket factory installed over flexible assembly.
    - c. Assembly, including insulation and vapor barrier, shall meet Class I requirement of NFPA 90A and be UL 181 rated, with flame spread of 25 or less and smoke developed rating of 50 or under.
    - d. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - 1) PR-25 by JP Lambornes.
      - 2) Flex-Vent KP by Thermaflex by Flexible Technologies.
      - 3) Type 1B Insulated by Flexmaster.
  - 2. Cinch Bands: Nylon, 3/8 inch removable and reusable type.
    - a. Listed and labeled in accordance with Standard UL 181B and labeled 'UL 181 B-C'.

**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. Install duct in fully extended condition free of sags and kinks, using 72 inch maximum lengths.
- B. Make duct connections by coating exterior of duct collar for 3 inches with duct sealer and securing duct in place over sheet metal collar with specified cinch bands.

**END OF SECTION**

**SECTION 23 3713****DIFFUSERS, REGISTERS, AND GRILLES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install diffusers, registers, and grilles connected to ductwork as described in Contract Documents.
- B. Related Requirements:
  - 1. Section 23 3001: 'General Duct Requirements'.

**1.2 SUBMITTALS**

- A. Maintenance Material Submittals:
  - 1. Tools: Leave tool for removing core of each different type of grille for building custodian.

**PART 2 - PRODUCTS****2.1 MANUFACTURERS**

- A. Manufacturer Contact List:
  - 1. Carnes Co, Verona, MI [www.carnes.com](http://www.carnes.com).
  - 2. J & J Register, Grand Rapids, MI [www.jandjreg.com](http://www.jandjreg.com).
  - 3. Krueger Air System Components, Richardson, TX [www.krueger-hvac.com](http://www.krueger-hvac.com).
  - 4. Metal\*Aire by Metal Industries Inc, Clearwater, FL [www.metalaire.com](http://www.metalaire.com).
  - 5. Nailor Industries Inc, Houston, TX or Weston, ON [www.nailor.com](http://www.nailor.com).
  - 6. Price Industries Inc, Suwanee, GA [www.price-hvac.com](http://www.price-hvac.com) or E H Price Ltd, Winnipeg, MB (204) 669-4220.
  - 7. Titus, Richardson, TX [www.titus-hvac.com](http://www.titus-hvac.com).
  - 8. Tuttle & Bailey, Richardson, TX [www.tuttleandbailey.com](http://www.tuttleandbailey.com).

**2.2 MANUFACTURED UNITS**

- A. Hard Ceiling Diffusers:
  - 1. Finish: Off-white baked enamel.
  - 2. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - a. Carnes: SKSA.
    - b. Krueger: SH Frame F21.
    - c. Metal\*Aire: 5500S-2.
    - d. Price: SMD.
    - e. Titus: TDC Border Type 6.
    - f. Tuttle & Bailey: MS.
- B. Low Sidewall Return Grilles:
  - 1. Finish: Off-white baked enamel.
  - 2. 38 or 45 degree deflection.
  - 3. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - a. Carnes: RSHA.
    - b. J & J: S-590.
    - c. Krueger: S480H.
    - d. Metal\*Aire: HD-RH.
    - e. Nailor: 6145H-HD.
    - f. Price: 91.

- g. Titus: 33RL or 33RS.
  - h. Tuttle & Bailey: T115D.
- C. Floor Return Grilles:
- 1. Finish: Clear anodized.
  - 2. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - a. Titus: CT-580 or equal by
    - b. Carnes
    - c. J & J
    - d. Krueger
    - e. Metal\*Aire
    - f. Nailor
    - g. Price
    - h. Titus: CT-540.
    - i. Tuttle & Bailey

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Anchor securely into openings. Secure frames to ductwork by using four sheet metal screws, one per side. Level floor registers and anchor securely into floor.

**END OF SECTION**

**SECTION 23 3723****HVAC GRAVITY VENTILATORS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install roof vents as described in Contract Documents.
- B. Related Requirements:
  - 1. Section 23 3001: 'Common Duct Requirements'.

**PART 2 - PRODUCTS****2.1 MANUFACTURERS**

- A. Manufacturer List:
  - 1. Air-Rite Manufacturing, Bountiful, UT (801) 295-2529.
  - 2. Breidert Air Products, Jacksonville, FL [www.breidert.com](http://www.breidert.com).
  - 3. Carnes Company, Verona, WI [www.carnes.com](http://www.carnes.com).
  - 4. Greenheck Fan Corporation, Schofield, WI [www.greenheck.com](http://www.greenheck.com).
  - 5. Loren Cook Co, Springfield, MO [www.lorencook.com](http://www.lorencook.com).
  - 6. United Enertech Corporation, Chattanooga, TN [www.unitedenertech.com](http://www.unitedenertech.com).
  - 7. Vent Products Co, Inc, Chicago, IL [www.ventprod.com](http://www.ventprod.com).

**2.2 MANUFACTURED UNITS**

- A. Louvered Penthouses:
  - 1. Fabricated from (0.081 inch) extruded aluminum.
    - a. All welded construction.
    - b. Screws or rivets will not be allowed.
  - 2. Blades:
    - a. Horizontal at 45 degree angle with return bends at upper edges.
    - b. Welded, mitered corners for continuous blade effect.
  - 3. Bird Screens: 1/2 inch square mesh 16 ga aluminum in extruded aluminum, rewirable frames on interior of louvers.
  - 4. Penthouse Finish: Clear anodized aluminum.
  - 5. Curbs:
    - a. Galvanized steel, insulated, factory-fabricated curb.
    - b. Insulation: Minimum 1-1/2 inches thick, 3 lb density fiber glass.
    - c. Curb Extension: 8 inches above finished roof level.
  - 6. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - a. Air-Rite Manufacturing: Model LPE-1.
    - b. Breidert: Model RLX.
    - c. Carnes: GLAB.
    - d. Cook: Type TRE.
    - e. Greenheck: WIH/WRH.
    - f. United Enertech: Model PEL-4.
    - g. Vent Products: Model 7100.

**PART 3 - EXECUTION: Not Used****END OF SECTION**

**SECTION 23 4100****AIR FILTERS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install filters used in mechanical equipment.
- B. Related Requirements:
  - 1. Section 23 3001: 'Common Duct Requirements'.
  - 2. Section 23 7223: 'Packaged Air-To-Air Energy Recovery Units'.
  - 3. Section 23 7313: 'Modular Indoor Central-Station Air Handling Units'.
  - 4. Section 23 7413: 'Packaged, Outdoor, Central-Station Air Handling Units'.
  - 5. Section 23 8219: 'Fan Coil Units'.

**1.2 REFERENCES**

- A. Reference Standard:
  - 1. American National Standards Institute (ANSI) / American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
    - a. ANSI/ASHRAE 52.2-2012, 'Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size'.

**PART 2 - PRODUCTS****2.1 MANUFACTURED UNITS**

- A. Furnace Filters: One inch thick throw-away type as recommended by Furnace Manufacturer.

**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. Provide ample access for filter removal.

**3.2 FIELD QUALITY CONTROL**

- A. Inspection: At date of Substantial Completion, air filters shall be new, clean, and approved by Owner's representative.

**END OF SECTION**



**SECTION 23 5135****AIR PIPING****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install heating equipment exhaust piping and combustion air intake piping as described in Contract Documents.
- B. Related Requirements:
  - 1. Section 07 6310: 'Steep Slope Roof Flashing: Asphalt Tile' for pipe flashing used on steep slope asphalt tile roofs only.
  - 2. Sections Under 09 9000 Heading: Painting.
  - 3. Section 22 3413: 'Instantaneous, Tankless, Gas Domestic Water Heaters'.
  - 4. Section 23 0501: 'Common HVAC Requirements'.
  - 5. Section 23 5417: 'Gas-Fired Furnaces'.

**1.2 REFERENCES**

- A. Reference Standards:
  - 1. ASTM International:
    - a. ASTM D1785-12, 'Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120'.
    - b. ASTM D2564-12, 'Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems'.
    - c. ASTM D2665-14, 'Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings'.

**PART 2 - PRODUCTS****2.1 ASSEMBLIES**

- A. Manufacturers:
  - 1. Manufacturer Contact List:
    - a. Armaflex by Armacell, Mebane, NC [www.armaflex.com](http://www.armaflex.com).
    - b. Nomaco, Youngsville, NC [www.nomacokflex.com](http://www.nomacokflex.com).
- B. Materials:
  - 1. Air Piping: Schedule 40 pipe and fittings meeting requirements of ASTM D1785, ASTM D2661, or ASTM D2665.
  - 2. Solvent Cement and Adhesive Primer:
    - a. Use PVC solvent cement that has a VOC content of 510 g/L or less if required by local AHJ if required.
    - b. Use adhesive primer that has a VOC content of 550 g/L or less if required by local AHJ if required.
    - c. Meet requirements of ASTM F656 for cement primer and ASTM D2564 for pipe cement.
  - 3. Flexible Foamed Pipe Insulation:
    - a. Thickness:
      - 1) 1/2 inch for 2 through 3 inch outside diameter pipe.
      - 2) 1/2 inch sheet for fittings as recommended by Manufacturer.
    - b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - 1) Tubolit by Armaflex.
      - 2) ImcoLock or Therma-Cel by Nomaco K-Flex.
  - 4. Insulation Joint Sealer:

- a. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
  - 1) 520 by Armaflex.
  - 2) R-320 by Nomaco K-Flex.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Installation For Condensing Furnaces:
  1. Run individual vent and individual combustion intake piping from each furnace to concentric roof termination kit provided by Furnace Manufacturer. Slope lines downward toward furnace.
  2. Slope combustion chamber drain downward to funnel drain. Anchor to wall with wall clamps, allowing free movement through clamp for expansion.
  3. Use concentric roof termination kit provided by Furnace Manufacturer. Install vent and combustion air intake piping at clearance and distances required by Furnace Manufacturer.
  4. Attach factory-supplied neoprene coupling to combustion-air inlet connection and secure with clamp.
  5. Ensure that factory-supplied perforated metal disc is installed in flexible coupling, unless its removal is required.
  6. York Furnaces: Install air piping on side of furnace in horizontal or vertical installation.
- B. Support:
  1. Support concentric roof termination kit at ceiling or roof line with 20 ga sheet metal straps as detailed on Drawings.
  2. Support horizontal and sloping sections of pipe with 1 inch wide 20 ga galvanized steel straps. Anchor securely to structure, not allowing pipe to sway.
- C. Insulation:
  1. General:
    - a. Install insulation in snug contact with pipe and in accordance with Manufacturer's recommendations.
    - b. Slip insulation on piping before piping sections and fittings are assembled keeping slitting of insulation to a minimum.
    - c. Joints:
      - 1) Place 'slit' joint seams of insulation exposed outside building on bottom of pipe.
      - 2) Stagger joints on layered insulation.
      - 3) Seal joints in insulation.
    - d. Paint exterior exposed insulation with two coats of finish recommended by Insulation Manufacturer, color selected by Architect.
  2. Install specified insulation on PVC air piping serving mechanical equipment as follows
    - a. Combustion air PVC piping in truss space and in attic.
    - b. Combustion vent PVC piping in attic, in truss space, and above roof.
    - c. Insulate fittings with sheet insulation and as recommended by Manufacturer.

**END OF SECTION**

**SECTION 23 5417****GAS-FIRED FURNACES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
1. Furnish and install horizontal/vertical gas-fired condensing furnaces as described in Contract Documents.
- B. Related Sections:
1. Section 23 0501: 'Common HVAC Requirements'.
  2. Section 23 1123: 'Facility Natural Gas Piping'.
  3. Section 23 2300: 'Refrigerant Piping'.
  4. Section 23 4100: 'Air Filters'.
  5. Section 23 5135: 'Air Piping'.
  6. Section 23 6214: 'Compressor Units: Air Conditioning (5 Ton or less)' for DX Cooling.

**1.2 SUBMITTALS**

- A. Informational Submittals:
1. Manufacturer Reports: Equipment check-out sheets.
- B. Special Procedure Submittals:
1. Installer must register with Manufacturer before submitting Manufacturer Warranty:
    - a. Installer to contact Owner's Representative (FM Group or Project Manager) for following MANDATORY information to be given to Manufacturer before Manufacturer will issue Manufacturer's 'Special LDS Warranty' included with Closing Submittal:
      - 1) This must be given to Manufacturer:
        - a) Name of Owner (name of FM Group) \_\_\_\_\_
        - b) Mailing Address (FM office address) \_\_\_\_\_
        - c) Building Property ID (unique 7-digit identifier) \_\_\_\_\_
        - d) Project site address: \_\_\_\_\_
        - e) Model Number of each Unit \_\_\_\_\_
        - f) Serial Number of each Unit \_\_\_\_\_
        - g) Date of Installation / Startup \_\_\_\_\_
      - b. Product Data for Prerequisite EQ 1:
        - 1) Documentation indicating that units comply with ANSI/ASHRAE 62.1, Section 5 - 'Systems and Equipment'.
      - c. Product Data for Credit EQ 4.1:
        - 1) For solvent cements and adhesive primers, including printed statement of VOC content.
- C. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    - a. Warranty Documentation:
      - 1) Final, executed copy of Manufacturer's 'Special LDS Warranty' including required Owner / Manufacturer mandatory information.
    - b. Record Documentation:
      - 1) Manufacturers Documentation:
        - a) Equipment checkout sheet: Complete and sign all items for each unit.

**1.3 WARRANTY**

- A. Manufacturer's Warranty:

1. Provide Manufacturer's 'Special LDS Warranty' for the following:
  - a. Provide fifteen (15) year minimum limited warranty of heat exchanger.
  - b. Provide five (5) year limited warranty on parts.

## **PART 2 - PRODUCTS**

### **2.1 ASSEMBLIES**

#### **A. Manufacturers:**

1. Manufacturer Contact List:
  - a. Carrier Corporation:
    - 1) Carrier National: Bradley Brunner (270) 282-1241 Bradley.M.Brunner@Carrier.com.
    - 2) Carrier Utah: Bret Adams (Contractors Heating/Cooling Supply) (801) 224-1020 ext. 2527 bret.adams@mc.supply
  - b. Lennox Industries:
    - 1) For pricing and information contact: Lennox Mountain Commercial @ 1-800-972-3283.
    - 2) Lennox National Contact: Jeff Barrett (801) 556-6114 jeff.barrett@lennoxind.com
  - c. York (US Air Conditioning Distributors):
    - 1) Nick Filimoehala (801) 463-5323 n.filimoehala@us-ac.com.

#### **B. Design Criteria:**

1. Rated at 92 percent minimum AFUE (Annual Fuel Utilization Efficiency) calculated in accordance with DOE test procedures.

#### **C. Manufactured Units:**

1. Furnaces:
  - a. Factory assembled units certified by AGA complete with blower section, furnace section, steel casing, piped, and wired.
  - b. Blower section shall consist of cabinet, blower, and motor.
    - 1) Cabinet shall be of 22 ga minimum cold rolled steel and have finish coat of baked-on enamel.
    - 2) Blower shall be Class 1, full DIDW, statically and dynamically balanced.
  - c. Automatic controls shall consist of:
    - 1) Manual gas shut-off valve.
    - 2) Operating automatic gas valve.
    - 3) Solid-state type fan and thermal limit controls.
    - 4) 24-volt transformer.
    - 5) Hot surface ignition system.
  - d. Blower shall be driven by multi-speed direct driven motor.
  - e. Furnace section shall be enclosed in 22 ga minimum enameled steel casing lined with foil covered insulation.
  - f. Heat Exchanger: Aluminized steel.
  - g. Gas Burners: Aluminized steel.
  - h. PVC intake of outside air and PVC combustion product exhaust, with sealed combustion, direct vent system.
  - i. Concentric roof termination kit for roof mounting.
  - j. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - 1) Standard Furnaces:
      - a) Carrier: 59SC5B.
      - b) Lennox: ML196E
      - c) York: TM9E
2. Cooling Coil:
  - a. Cooling coil shall consist of heavy gauge steel cabinet with baked-on enamel finish to match furnace:
    - 1) Coil shall have aluminum fins bonded to seamless copper or aluminum tubing.
    - 2) Coil shall be ARI rated. Provide drain pans with connections at one end.
    - 3) Use thermal expansion valve.
  - b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:

- 1) Vertical:
  - a) Carrier: CNPVP.
  - b) Lennox: CX35.
  - c) York: CF.

## 2.2 ACCESSORIES

- A. Filter Frame:
  1. Build filter frame external to furnace as detailed on Contract Drawings.
- B. Vibration Isolators:
  1. Vertical Installation: 4 inches square by 1/2 inch thick minimum neoprene type vibration isolation pads.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Vibration Isolators:
  1. Install vibration isolator on each hanger rod supporting horizontal furnace and under each corner of vertical furnace.

### 3.2 FIELD QUALITY CONTROL

- A. Manufacturer Services:
  1. Furnace installer shall:
    - a. Verify proper gas orifice size.
    - b. Clock gas meter for rated input.
    - c. Verify and set gas pressure at furnace.
    - d. Check and measure temperature rise.
    - e. Check safety controls for proper operation.
    - f. Check combustion vent sizes and combustion air sizes.
  2. In addition, furnace installer shall start up, check out, and adjust furnaces using equipment check-out sheet provided by Manufacturer. Complete and sign all items on sheet.

**END OF SECTION**

**SECTION 23 6214****COMPRESSOR UNITS: Air Conditioning (5 Ton or less)****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
1. Furnish and install compressor units as described in contract documents.
  2. Furnish and install compressor units and roof mounted compressor unit curbs as described in Contract Documents.
- B. Related Sections:
1. Section 06 2001: 'Common Finish Carpentry Requirements' for blocking at roof mounted compressor unit curb locations.
  2. Sections under Heading 07 5000 Membrane Roofing.
  3. Section 23 0501: 'Common HVAC Requirements'.
  4. Section 23 2300: 'Refrigerant Piping'.
  5. Section 23 5417: 'Gas-Fired Furnaces'.

**1.2 REFERENCES**

- A. Definitions:
1. Compressor: Pump that increases vapor (refrigerant or air) pressure from one level to a higher level of pressure.
  2. Compressor Unit: Outside section of an air conditioning system which pumps vaporized refrigerant from the evaporator, compresses it, liquefies it in the condenser and returns it to the evaporator coil. The outdoor portion of a split system air conditioner contains the compressor and outdoor coil.
  3. Condenser: Device used to condense refrigerant in a cooling system.
  4. Condenser Coils: In a compressor unit, the coil dissipates heat from the refrigerant, changing the refrigerant from vapor to liquid.
  5. Refrigerant: Absorbs heat by a change of state (evaporation) from liquid to a gas, and releases heat by a change of state (condenses) from gas back to a liquid.
  6. SEER (Seasonal Energy Efficiency Ratio): Measure of cooling efficiency for air conditioners and heat pumps. A ratio of total cooling in comparison to electrical energy input in watts per hour. Higher the seer, the more energy efficient the unit. Since 2006, the minimum SEER required by the Department of Energy is 13.00 and 15.00+ SEER is considered high efficiency.
  7. Split System: Combination of an outdoor unit (air conditioner or heat pump) with an indoor unit (furnace or air handler). Split systems must be matched for optimum efficiency.
- B. Reference Standards:
1. American National Standards Institute / Air-Conditioning, Heating, and Refrigeration Institute:
    - a. ANSI/AHRI Standard 210/240-2008, 'Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment' (formerly ARI Standard 210/240).
  2. American National Standards Institute / American Society of Heating, Refrigerating and Air-Conditioning Engineers:
    - a. ANSI/ASHRAE Standard 15-2010, 'Safety Standard for Refrigeration Systems'.
    - b. ANSI/ASHRAE Standard 34-2010, 'Designation and Classification of Refrigerants'.
  3. ASTM International:
    - a. ASTM A615/A615M-14, 'Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement'.
    - b. ASTM C920-14, 'Standard Specification for Elastomeric Joint Sealants'.

### 1.3 SUBMITTALS

- A. Action Submittals:
1. Shop Drawings:
    - a. 'Compressor Unit Curb':
      - 1) Provide fabrication details and sections with dimensions and materials used including reinforcing showing compliance to Contract Drawings.
- B. Informational Submittals:
1. Tests and Evaluation Reports:
    - a. Manufacturer Reports: Equipment check-out sheets.
- C. Special Procedure Submittals:
1. Installer must register with Manufacturer before submitting Manufacturer Warranty:
    - a. Installer to contact Owner's Representative (FM Group or Project Manager) for following MANDATORY information to be given to Manufacturer before Manufacturer will issue Manufacturer's 'Special LDS Warranty' included with Closing Submittal:
      - 1) This must be given to Manufacturer:
        - a) Name of Owner (name of FM Group) \_\_\_\_\_
        - b) Mailing Address (FM office address) \_\_\_\_\_
        - c) Building Property ID (unique 7 digit identifier) \_\_\_\_\_
        - d) Project site address: \_\_\_\_\_
        - e) Model Number of each Unit \_\_\_\_\_
        - f) Serial Number of each Unit \_\_\_\_\_
        - g) Date of Installation / Startup \_\_\_\_\_
  2. Qualification Statements:
    - a. Technician certificate for use in HFC and HCFC refrigerants.
- D. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    - a. Warranty Documentation:
      - 1) Final, executed copy of Manufacturer's 'Special LDS Warranty' including required Owner / Manufacturer mandatory information.
    - b. Record Documentation:
      - 1) Manufacturers Documentation:
        - a) Equipment checkout sheet: Complete and sign all items for each unit.

### 1.4 QUALITY ASSURANCE

- A. Regulatory Agency Sustainability Approvals:
1. Each unit shall be UL / ULC or ETL labeled.
  2. Comply with ANSI/AHRI Standard 210/240.
  3. Refrigeration compressor, coils, and specialties shall be designed to operate with CFC-free refrigerants.
- B. Qualifications. Section 01 4301 applies, but is not limited to the following:
1. Installer: Refrigerant piping shall be installed by refrigeration contractor licensed by State and by technicians certified in use of HFC and HCFC refrigerants.

### 1.5 WARRANTY

- A. Manufacturer's Warranty:
1. Provide Manufacturer's 'Special LDS Warranty' for the following:
    - a. Provide ten (10) year limited warranty on compressor.
    - b. Provide five (5) year limited warranty on parts from date of 'start-up'.

## PART 2 - PRODUCTS

### 2.1 ASSEMBLIES

#### A. Manufacturers:

1. Manufacturer Contact List:
  - a. Carrier Corporation:
    - 1) Carrier National: Bradley Brunner (270) 282-1241 Bradley.M.Brunner@Carrier.utc.com.
    - 2) Carrier Utah: Bret Adams (Contractors HVAC Supply) (801) 224-1020 ext. 2527  
bret.adams@chcsut.com.
  - b. Lennox Industries:
    - 1) For pricing and information call Lennox National Account at (800) 367-6285.
    - 2) Lennox National Contact: Cody Jackson (801) 736-8904  
Cody.Jackson@LennoxInd.com.
  - c. York International:
    - 1) Brian Michael (405) 419-6230 brian.k.michael@jci.com.

#### B. Performance:

1. Capacities: SEER rating as defined by AHRI shall be 13.0 or greater.

#### C. Manufactured Units:

1. Compressor Units (5 Tons or Less):
  - a. General:
    - 1) Units shall be operable down to 0 deg F outdoor temperature.
    - 2) Use R-410a refrigerant.
    - 3) Only one liquid line, one suction line, and one power connection shall be made to each compressor. Provide charging valves.
  - b. Condenser Coils:
    - 1) Aluminum plate fins mechanically bonded to seamless copper tubes or 'Spine Fin' trade mark system which has aluminum fins epoxy bonded to aluminum tubes or micro-channel.
    - 2) Provide stamped louver coil guard for unit.
  - c. Fans:
    - 1) Direct driven propeller type.
    - 2) Fan motor shall be single or two speed, thermostatically controlled, permanently lubricated, and designed with permanent protection.
    - 3) Motors shall be resiliently mounted.
    - 4) Each fan shall have a safety guard.
  - d. Compressor:
    - 1) Each condenser unit shall have only one compressor.
    - 2) Design with following features:
      - a) Externally mounted brass service valves with charging connections.
      - b) Crankcase heater.
      - c) Resilient rubber mounts.
      - d) Compressor motor-overload protection.
      - e) Single speed.
  - e. Controls:
    - 1) Factory wired and located in separate enclosure.
    - 2) Following three paragraphs may not be factory installed and will therefore have to be field installed.
    - 3) Safety devices:
      - a) High and low pressure cutout.
      - b) Condenser fan motor-overload devices.
    - 4) Anti-cycle timers to prevent units from starting up again for five minutes after any power interruption.
    - 5) Head pressure type low ambient kit.
  - f. Casing:
    - 1) Fully weatherproof for outdoor installation. Finish shall be weather resistant.
  - g. Openings shall be provided for power and refrigerant connections.



- h. Panels shall be removable for servicing.
- i. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
  - 1) North Region:
    - a) Carrier: 24ABB3.
    - b) Lennox: 13ACXN.
    - c) York: YCD.

## 2.2 ACCESSORIES

- A. 'Z' Clip:
  - 1. 18 ga (0.0516 in) in width and height as shown on Contract Drawings.
- B. Vibration Isolators:
  - 1. 4 inches square by 3/4 inch thick minimum neoprene type vibration isolation pads.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification Of Conditions:
  - 1. Verify blocking installed under roof decking is in correct location to attach 'compressor unit curb'.
  - 2. Notify Architect of unsuitable conditions in writing
  - 3. Commencement of Work by Installer is considered acceptance of substrate.

### 3.2 INSTALLATION

- A. General:
  - 1. Set compressor units level on concrete slab on vibration isolation pads located at each corner of unit. This does not apply to compressor units that have composite non-metal bottom.
  - 2. Compressor unit to be anchored solidly to concrete slab.
  - 3. Do not use capillary tube and piston type refrigerant metering devices.

### 3.3 INSTALLATION

- A. General:
  - 1. Coordinate with other trades affected by the Work of this section.
- B. Compressor Units:
  - 1. Set compressor units level on 'compressor unit curb' on vibration isolation pads located at each corner of unit. This does not apply to compressor units that have composite non-metal bottom.
  - 2. Attach compressor units to 'compressor unit curb' with 'Z' clips and attachment screws post drilled into concrete inside 'curb body' at all four (4) sides.
  - 3. Do not use capillary tube and piston type refrigerant metering devices.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer Services:
  - 1. Compressor units shall be started up, checked out, and adjusted by compressor unit Installer.
  - 2. Use equipment checkout sheet provided by Manufacturer:
    - a. Complete and sign all items on sheet.

**END OF SECTION**

**DIVISION 26: ELECTRICAL**

**26 0500 COMMON WORK RESULTS FOR ELECTRICAL**

- 26 0501 COMMON ELECTRICAL REQUIREMENTS
- 26 0519 LINE-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
- 26 0523 CONTROL-VOLTAGE ELECTRICAL CABLES
- 26 0526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
- 26 0533 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS SCHEDULE
- 26 0613 ELECTRICAL EQUIPMENT MOUNTING  
HEIGHT SCHEDULE

**26 2000 LOW-VOLTAGE ELECTRICAL TRANSMISSION**

- 26 2726 WIRING DEVICES
- 26 2816 ENCLOSED SWITCHES AND CIRCUIT  
BREAKERS

**26 5000 LIGHTING**

- 26 5100 INTERIOR LIGHTING

END OF TABLE OF CONTENTS

**SECTION 26 0501****COMMON ELECTRICAL REQUIREMENTS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. General electrical system requirements and procedures.
  - 2. Perform excavating and backfilling work required by work of this Division as described in Contract Documents.
  - 3. Make electrical connections to equipment provided under other Sections.
- B. Products Furnished But Not Installed Under This Section:
  - 1. Anchor bolts and templates for exterior lighting equipment bases.
- C. Related Requirements:
  - 1. Section 01 3200: 'Construction Process Documentation' for scheduling of equipment and materials removed by Owner.
  - 2. Section 02 4119: 'Selective Structure Demolition' for salvage of existing electrical items to be reused or recycled.

**1.2 REFERENCES**

- A. Reference Standards:
  - 1. National Fire Protection Association / American National Standards Institute:
    - a. NFPA 70, 'National Electrical Code (NEC)' (2017 or most recent edition adopted by AHJ).
  - 2. National Electrical Manufacturing Association Standards (NEMA):
    - a. NEMA 250-2018, 'Enclosure for Electrical Equipment (1000 Volts Maximum)'.

**1.3 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate with Owner for equipment and materials to be removed by Owner.
- B. Sequencing:
  - 1. Include detailed sequence of individual electrical demolition operations on Construction Schedule specified in Section 01 3200.

**1.4 SUBMITTALS**

- A. Action Submittals:
  - 1. Product Data:
    - a. Provide following information for each item of equipment:
      - 1) Catalog Sheets.
      - 2) Assembly details or dimension drawings.
      - 3) Installation instructions.
      - 4) Manufacturer's name and catalog number.
      - 5) Name of local supplier.
    - b. Furnish such information for following equipment:
      - 1) Section 26 2726: 'Wiring Devices'

- 2) Section 26 2816: 'Enclosed Switches And Circuit Breakers'.
  - 3) Section 26 5100: 'Interior Lighting Fixtures'.
  - 4) Section 26 5200: 'Emergency Lighting'
  - c. Do not purchase equipment before approval of product data.
- B. Informational Submittals:
1. Test And Evaluation Reports:
    - a. Report of site tests, before Substantial Completion.
  2. Qualification Statement:
    - a. Electrical Subcontractor:
      - 1) Provide Qualification documentation if requested by Architect or Owner.
    - b. Installer:
      - 1) Provide Qualification documentation if requested by Architect or Owner.
- C. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    - a. Operations and Maintenance Data:
      - 1) Provide operating and maintenance instructions for each item of equipment submitted under Product Data.
    - b. Record Documentation:
      - 1) Manufacturers documentation:
        - a) Manufacturer's literature.
        - b) Include copy of approved shop drawings.

## 1.5 QUALITY ASSURANCE

- A. Regulatory Agency Sustainability Approvals:
1. NEC and local ordinances and regulations shall govern unless more stringent requirements are specified.
  2. Material and equipment provided shall meet standards of NEMA or UL and bear their label wherever standards have been established and label service is available.
- B. Qualifications: Requirements of Section 01 4301 applies, but not limited to following:
1. Electrical Subcontractor:
    - a. Company specializing in performing work of this section.
      - 1) Minimum five (5) years experience in electrical installations.
      - 2) Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
    - b. Upon request, submit documentation.
  2. Installer:
    - a. Licensed for area of Project.
    - b. Designate one (1) individual as project foremen who shall be on site at all times during installation and experienced with installation procedures required for this project.
    - c. Upon request, submit documentation.

## PART 2 - PRODUCTS

### 2.1 SYSTEMS

- A. Performance:
1. Design Criteria:
    - a. Materials and equipment provided under following Sections shall be by same Manufacturer:
      - 1) Section 26 2816: Enclosed Switches And Circuit Breakers.

## **PART 3 - EXECUTION**

### **3.1 INSTALLERS**

- A. Acceptable Installers:
  - 1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

### **3.2 EXAMINATION**

- A. Verification Of Conditions:
  - 1. Confirm dimensions, ratings, and specifications of equipment to be installed and coordinate these with site dimensions and with other Sections.
- B. Evaluation And Assessment:
  - 1. All relocations, reconnections, and removals are not necessarily indicated on Drawings. Include such work without additional cost to Owner.

### **3.3 PREPARATION**

- A. Disconnect equipment that is to be removed or relocated. Carefully remove, disassemble, or dismantle as required, and store in approved location on site, existing items to be reused in completed work.
- B. Where affected by demolition or new construction, relocate, extend, or repair raceways, conductors, outlets, and apparatus to allow continued use of electrical system. Use methods and materials as specified for new construction.
- C. Perform drilling, cutting, block-offs, and demolition work required for removal of necessary portions of electrical system. Do not cut joists, beams, girders, trusses, or columns without prior written permission from Architect.
- D. Remove concealed wiring abandoned due to demolition or new construction. Remove circuits, conduits, and conductors that are not to be re-used back to next active fixture, device, or junction box.
- E. Patch, repair, and finish surfaces affected by electrical demolition work, unless work is specifically specified to be performed under other Sections of the specifications.

### **3.4 INSTALLATION**

- A. General:
  - 1. Locations of electrical equipment shown on Drawings are approximate only. Field verify actual locations for proper installation.
  - 2. Coordinate electrical equipment locations and conduit runs with those providing equipment to be served before installation or rough in.
    - a. Notify Architect of conflicts before beginning work.
    - b. Coordinate locations of power and lighting outlets in mechanical rooms and other areas with mechanical equipment, piping, ductwork, cabinets, etc, so they will be readily accessible and functional.
  - 3. Work related to other trades which is required under this Division, such as cutting and patching, trenching, and backfilling, shall be performed according to standards specified in applicable Sections.

### **3.5 FIELD QUALITY CONTROL**

#### **A. Field Tests:**

1. Test systems and demonstrate equipment as working and operating properly. Notify Architect before test. Rectify defects at no additional cost to Owner.
2. Measure current for each phase of each motor under actual final load operation, i.e. after air balance is completed for fan units, etc. Record this information along with full-load nameplate current rating and size of thermal overload unit installed for each motor.

### **3.6 CLEANING**

- #### **A. Remove obsolete raceways, conductors, apparatus, and lighting fixtures promptly from site and dispose of legally.**

### **3.7 CLOSEOUT ACTIVITIES**

#### **A. Training:**

1. Provide competent instructor for three (3) days to train Owner's maintenance personnel in operation and maintenance of electrical equipment and systems. Factory representatives shall assist this instruction as necessary. Schedule instruction period at time of final inspection.

**END OF SECTION**

**SECTION 26 0519****LINE-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Quality of conductors used on Project except as excluded below.
- B. Related Requirements:
  - 1. Section 23 0933: 'Electric and Electronic Control System for HVAC' for conductors and cables for temperature control system.
  - 2. Section 26 0501: 'Common Electrical Requirements'.

**1.2 REFERENCES**

- A. Definitions:
  - 1. Line Voltage: Over 70 Volts.
- B. Reference Standards:
  - 1. National Fire Protection Association:
    - a. NFPA 70, 'National Electric Code (NEC)' (2017 or most recent edition adopted by AHJ including all applicable amendments and supplements).

**PART 2 - PRODUCTS****2.1 SYSTEMS**

- A. Line Voltage Conductors:
  - 1. Copper with AWG sizes as shown:
    - a. Minimum size shall be No. 12 except where specified otherwise.
    - b. Conductor size No. 8 and larger shall be stranded.
  - 2. Insulation:
    - a. Standard Conductor Size No. 10 And Smaller: 600V type THWN or XHHW (75 deg F (24 deg C)).
    - b. Standard Conductor Size No. 8 And Larger: 600V Type THW, THWN, or XHHW (75 deg F (24 deg C)).
    - c. Higher temperature insulation as required by NFPA 70 or local codes.
  - 3. Colors:
    - a. 208Y / 120 V System:
      - 1) Black: Phase A.
      - 2) Red: Phase B.
      - 3) Blue: Phase C.
      - 4) Green: Ground.
      - 5) White: Neutral
    - b. 120 / 240V System:
      - 1) Black: Phase A
      - 2) Red: Phase B
      - 3) White with Black Stripe: Neutral A
      - 4) White with Red Stripe: Neutral B
      - 5) Gray: Neutral (shared when allowed)

- 6) Green: Ground
  - c. Conductors size No. 10 and smaller shall be colored full length. Tagging or other methods for coding of conductors size No. 10 and smaller not allowed.
  - d. For feeder conductors larger than No. 10 at pull boxes, gutters, and panels, use painted or taped band or color tag color-coded as specified above.
- B. Line Voltage Cables:
1. Metal Clad Cable (MC) may be used as restricted below:
    - a. Copper conductors.
    - b. Sizes #12 through #8.
    - c. Use only in indoor dry locations where:
      - 1) Not subject to damage.
      - 2) Not in contact with earth.
      - 3) Not in concrete.
- C. Standard Connectors:
1. Conductors No. 8 And Smaller: Steel spring wire connectors.
  2. Conductors Larger Than No. 8: Pressure type terminal lugs.
  3. Connections Outside Building: Watertight steel spring wire connections with waterproof, non-hardening sealant.
- D. Terminal blocks for tapping conductors:
1. Terminals shall be suitable for use with 75 deg F (24 deg C) copper conductors.
  2. Acceptable Products:
    - a. 16323 by Cooper Bussmann, Ellisville, MO [www.bussmann.com](http://www.bussmann.com)
    - b. LBA363106 by Square D Co, Palatine, IL [www.us.squared.com](http://www.us.squared.com).
    - c. Equal as approved by Architect before bidding. See Section 01 6200.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General:
1. Conductors and cables shall be continuous from outlet to outlet.
  2. Do not use direct burial cable.
- B. Line Voltage Conductors:
1. Install conductors in raceway where indicated on Contract Drawings. Run conductors of different voltage systems in separate conduits.
  2. Route circuits at own discretion, however, circuiting shall be as shown in Panel Schedules. Group circuit homeruns to panels as shown on Contract Drawings.
  3. Neutrals:
    - a. On three-phase, 4-wire systems, do not use common neutral for more than three circuits.
    - b. On single-phase, 3-wire systems, do not use common neutral for more than two circuits.
    - c. Run separate neutrals for each circuit where specifically noted on Contract Drawings.
    - d. Where common neutral is run for two or three home run circuits, connect phase conductors to breakers in panel which are attached to separate phase legs:
      - 1) Provide breaker tie so that all circuits that share common neutral are simultaneously disconnected.
      - 2) Neutral conductors shall be of same size as phase conductors unless specifically noted otherwise.
  4. Pulling Conductors:
    - a. Do not pull conductors into conduit until raceway system is complete and cabinets and outlet boxes are free of foreign matter and moisture.
    - b. Do not use heavy mechanical means for pulling conductors.
    - c. Use only listed wire pulling lubricants.



- C. Line Voltage Cables:
1. Route circuits at own discretion, however, circuiting and numbering shall be as shown in Panel Schedules.
  2. Support cables using approved staples, cable ties, straps, hangers, or similar fittings, spaced as required.
  3. Where installing in framing, do not bore holes in joists or beams outside center 1/3 of member depth or within 24 inches (600 mm) of bearing points. Do not bore holes in vertical framing members outside center 1/3 of member width. Holes shall be one inch diameter maximum.
  4. Conceal cables within ceilings and walls of finished areas. Cables may be exposed in unfinished areas but not run on floors of mechanical equipment spaces or in such a way that they obstruct access to, operation of, or servicing of equipment.
  5. Install exposed cables parallel to or at right angles to building structure lines.
  6. Keep cables 6 inches (150 mm) minimum from hot water pipes.
  7. Do not support cables from mechanical ducts or duct supports without Architect's written approval.
  8. Prohibited procedures:
    - a. Boring holes for installation of cables in vertical truss members.
    - b. Notching of structural members for installation of cables.

**END OF SECTION**

**SECTION 26 0523****CONTROL-VOLTAGE ELECTRICAL CABLES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install control-voltage electrical cables as described in Contract Documents.
- B. Related Requirements:
  - 1. Section 23 0933: 'Electric And Electronic Control System For HVAC' for cables for Temperature Control System cables.
  - 2. Section 26 0501: 'Common Electrical Requirements'.

**1.2 REFERENCES**

- A. Definitions:
  - 1. Control Voltage: 70 Volts and under.

**PART 2 - PRODUCTS****2.1 SYSTEM**

- A. Manufacturers:
  - 1. Category Four Approved Cable Manufacturers. See Section 01 6200 for definitions of Categories:
    - a. Alpha Wire Co, Elizabeth, NJ [www.alphawire.com](http://www.alphawire.com).
    - b. Belden Wire & Cable Co, Richmond, IN [www.belden.com](http://www.belden.com).
    - c. Liberty Wire & Cable, Colorado Springs, CO [www.libertycable.com](http://www.libertycable.com).
    - d. West Penn Wire Corp, Washington, PA [www.westpenn-cdt.com](http://www.westpenn-cdt.com).
- B. Components:
  - 1. Building Control System Cables.
    - a. CAT 5E, 24 AWG, solid bare copper, four pair, UTP, white cable jacket.

**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. General:
  - 1. Cables shall be continuous and without splices from source to outlet.
  - 2. Conceal cables within ceilings and walls of finished areas. Cables may be exposed in unfinished areas but not run on floors of mechanical equipment spaces or in such a way that they obstruct access to, operation of, or servicing of equipment unless otherwise indicated in Contract Drawings.
  - 3. Run exposed cables parallel to or at right angles to building structure lines.
  - 4. Keep cables 6 inch (150 mm) minimum from hot water pipes.
  - 5. Support cables using approved staples, cable ties, straps, hangers, or similar fittings spaced every 3 feet (900 mm).

6. Where installing in framing, do not bore holes in joists or beams outside center 1/3 of member depth or within 24 inches (600 mm) of bearing points. Do not bore holes in vertical framing members outside center 1/3 of member width. Holes shall be 1/2 inch (13 mm) diameter maximum.
  7. Bundle only cables of same systems together.
  8. Do not run cables within 10 inches (255 mm) of line voltage conductors/raceways.
  9. Extend cables 18 inches (450 mm) from wall or ceiling at all outlet locations. Extend cables to twice vertical length of cabinet at each cabinet location.
  10. Prohibited procedures:
    - a. Boring holes for installation of cables in vertical truss members.
    - b. Notching of structural members for installation of cables.
- B. Control Cables:
1. For cables not installed in raceway, do not run cables within 10 inches (255 mm) of line voltage conductors / raceways.

**END OF SECTION**

**SECTION 26 0526****GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install grounding for electrical installation as described in Contract Documents except as excluded below.
- B. Related Requirements:
  - 1. Section 26 0501: 'Common Electrical Requirements'.

**1.2 REFERENCES**

- A. Reference Standards:
  - 1. Institute of Electrical and Electronics Engineers (IEEE):
    - a. IEEE 837-2014, 'Standard for Qualifying Permanent Connections Used in Substation Grounding'.
  - 2. National Fire Protection Association:
    - a. NFPA 70, 'National Electric Code (NEC)' (2017 or most recent edition adopted by AHJ including all applicable amendments and supplements).
    - b. NFPA 780, 'Standard for the Installation of Lightning Protection Systems' (2014 or latest approved edition).
  - 3. Telecommunications Industry Association:
    - a. TIA-942 A, 'Telecommunications Infrastructure Standard for Data Centers' (2014).
  - 4. Section 27 1116: 'Communications Cabinets, Racks, Frames, and Enclosures'.
  - 5. Section 27 1501: 'Communications Horizontal Cabling' for cables for Telephone and Data Systems.

**1.3 QUALITY ASSURANCE**

- A. Regulatory Agency Sustainability Approvals:
  - 1. Requirements of Section 27 1501 applies, but is not limited to following:
    - a. Cable assemblies shall be UL / CE Listed and CSA Certified. Cables shall be a distinctive green or green/yellow in color, and all jackets shall be UL, VW-1 flame rated.
    - b. Grounding shall conform to all required Commercial Building Grounding and Bonding Requirements for Telecommunications, Electrical Codes, and Manufacturer's grounding requirements.
  - 2. Systems shall be installed per NFPA 780 and NFPA 70.
  - 3. All Bonds shall comply with most current version of IEEE 837 Standard.
- B. Qualifications: Requirements of Section 01 4301 applies, but is not limited to following:
  - 1. Installers Qualifications:
    - a. Grounding and Bonding:
      - 1) Licensed electrical contractor shall perform installation and termination of main bonding conductor to building service entrance ground.
      - 2) Licensed in State that Work is to be performed.

## PART 2 - PRODUCTS

### 2.1 SYSTEM

- A. Manufacturers:
  - 1. Type One Acceptable Products:
    - a. 'Cadweld' by Erico International, Solon, OH [www.erico.com](http://www.erico.com).
    - b. 'ThermOweld' by Continental Industries, Tulsa, NE [www.conind.com](http://www.conind.com).
    - c. Equal as approved by Architect before bidding. See Section 01 6200.
- B. Performance:
  - 1. Design Criteria:
    - a. Size materials as shown on Drawings and in accordance with applicable codes.
    - b. Bonding System Workmanship:
      - 1) The ground/earthing system shall be designed for high reliability and shall meet following criteria:
        - a) Local electrical codes shall be adhered to.
        - b) All grounding/earthing conductors shall be copper.
        - c) Regulatory Agency Sustainability Approvals requirements are required.
- C. Materials:
  - 1. Grounding And Bonding Jumper Conductors: Bare copper or with green insulation.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Interface With Other Work: Coordinate with Section 03 3111 in installing grounding conductor and placing concrete. Do not allow placement of concrete before Architect's inspection of grounding conductor installation.
- B. Grounding conductors and bonding jumper conductors shall be continuous from terminal to terminal without splice. Provide grounding for following.
  - 1. Conduits and other conductor enclosures.
  - 2. Neutral or identified conductor of interior wiring system.
  - 3. Non-current-carrying metal parts of fixed equipment such as motors, starter and controller cabinets, instrument cases, and lighting fixtures.
- C. Pull grounding conductors in non-metallic raceways, in flexible steel conduit exceeding 72 inches (1 800 mm) in length, and in flexible conduit connecting to mechanical equipment.
- D. On motors, connect ground conductors to conduit with approved grounding bushing and to metal frame with bolted solderless lug.

**END OF SECTION**

**SECTION 26 0533****RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Quality of material and installation procedures for raceway, boxes, and fittings used on Project but furnished under other Divisions.
  - 2. Furnish and install raceway, conduit, and boxes used on Project not specified to be installed under other Divisions.
  
- B. Related Requirements:
  - 1. Section 23 0933: 'Electric and Electronic Control System for HVAC' for concealed raceway and extensions for temperature control system.
  - 2. Section 26 0501: 'Common Electrical Requirements' for general electrical requirements'.
  - 3. Section 27 1501: 'Communications Horizontal Cabling' for raceway for telephone and data systems.

**1.2 REFERENCES**

- A. Reference Standards:
  - 1. National Fire Protection Association:
    - a. NFPA 70, 'National Electric Code (NEC)' (2017 or most recent edition adopted by AHJ including all applicable amendments and supplements).

**PART 2 - PRODUCTS****2.1 SYSTEM**

- A. Manufacturers:
  - 1. Manufacturer Contact List:
    - a. Cooper B-Line, Highland, IL [www.b-line.com](http://www.b-line.com).
    - b. Hubbell Incorporated, Milford, CT [www.hubbell-wiring.com](http://www.hubbell-wiring.com) or Hubbell Canada Inc, Pickering, ON (905) 839-4332.
    - c. Square D, Palatine, IL [www.squared.com](http://www.squared.com).
    - d. Thomas & Betts, Memphis, TN [www.tnb.com](http://www.tnb.com) or Thomas & Betts Ltd, Iberville, PQ (450) 347-5318.
    - e. Walker Systems Inc, Williamstown, WV (800) 240-2601 or Walker Systems Inc / Wiremold Canada Inc, Fergus, ON (519) 843-4332.
    - f. Wiremold Co, West Hartford, CT [www.wiremold.com](http://www.wiremold.com).
  
- B. Materials:
  - 1. Raceway And Conduit:
    - a. Sizes:
      - 1) 3/4 inch (19 mm) for exterior use, unless indicated otherwise.
      - 2) 1/2 inch (13 mm) for interior use, unless indicated otherwise.
    - b. Types: Usage of each type is restricted as specified below by product.
      - 1) Galvanized rigid steel or galvanized intermediate metal conduit (IMC) is allowed for use in all areas. Where in contact with earth or concrete, wrap buried galvanized rigid steel and galvanized IMC conduit and fittings completely with vinyl tape.

- 2) Galvanized Electrical Metallic Tubing (EMT) and Flexible Steel Conduit:
  - a) Allowed for use only in indoor dry locations where it is:
    - (1) Not subject to damage.
    - (2) Not in contact with earth.
    - (3) Not in concrete.
  - b) For metal conduit systems, flexible steel conduit is required for final connections to indoor mechanical equipment.
- 3) Schedule 40 Polyvinyl Chloride (PVC) Conduit:
  - a) Allowed for use only underground or below concrete with galvanized rigid steel or IMC elbows and risers.
- 4) Listed, Liquid-Tight Flexible Metal Conduit:
  - a) Use in outdoor final connections to mechanical equipment, length not to exceed 36 inches (900 mm).
- 5) Pre-wired 3/8 Inch (9.5 mm) Flexible Fixture Whips: Allowed only for connection to recessed lighting fixtures, lengths not to exceed 72 inches (1 800 mm).
- c. Prohibited Raceway Materials:
  - 1) Aluminum conduit.
  - 2) Armored cable type AC (BX) cable.
2. Raceway And Conduit Fittings:
  - a. Rigid Steel Conduit And IMC: Threaded and designed for conduit use.
  - b. EMT:
    - 1) Compression type.
    - 2) Steel set screw housing type.
  - c. PVC Conduit:
    - 1) PVC type. Use PVC adapters at all boxes.
    - 2) PVC components, (conduit, fittings, cement) shall be from same Manufacturer.
  - d. Flexible Steel Conduit: Screw-in type.
  - e. Liquid-tight Flexible Metal Conduit: Sealrite type.
  - f. Expansion fittings shall be equal to OZ Type AX sized to raceway and including bonding jumper.
  - g. Prohibited Fitting Materials:
    - 1) Crimp-on, tap-on, indenter type fittings.
    - 2) Cast set-screw fittings for EMT.
    - 3) Spray (aerosol) PVC cement.
3. Seal Devices: OZ Type WSK.
4. Outlet Boxes:
  - a. Galvanized steel of proper size and shape are acceptable for all systems. Where metal boxes are used, provide following:
    - 1) Provide metal supports and other accessories for installation of each box.
    - 2) Equip ceiling and bracket fixture boxes with fixture studs where required.
    - 3) Equip outlets in plastered, paneled, and furred finishes with plaster rings and extensions to bring box flush with finish surface.
  - b. HVAC Instrumentation And Control:
    - 1) Junction boxes in mechanical equipment areas shall be 4 inches (100 mm) square.
    - 2) Boxes for remote temperature sensor devices shall be recessed single device.
    - 3) Boxes for thermostats shall be 4 inches (100 mm) square with raised single device cover.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions:
  1. Confirm dimensions, ratings, and specifications of materials to be installed and coordinate these with site dimensions and with other Sections.

### 3.2 INSTALLATION

- A. Interface with Other Work:
1. Coordinate with Divisions 22 and 23 for installation of raceway for control of HVAC equipment.
  2. Before rough-in, verify locations of boxes with work of other trades to ensure that they are properly located for purpose intended.
  3. Install pull wires in raceways installed under this Section where conductors or cables are to be installed under other Divisions.
- B. Conduit And Raceway:
1. Conceal raceways within ceilings, walls, and floors, except at Contractor's option, conduit may be exposed on walls or ceilings of mechanical equipment areas and above acoustical panel suspension ceiling systems. Install exposed raceway runs parallel to or at right angles to building structure lines.
  2. Seal all raceways penetrating fire rated walls, ceilings and barriers. See Section 07 8400.
  3. Keep raceway runs 6 inches (150 mm) minimum from hot water pipes.
  4. Make no more than four quarter bends, 360 degrees total, in any conduit run between outlet and outlet, fitting and fitting, or outlet and fitting.
    - a. Make bends and offsets so conduit is not injured and internal diameter of conduit is not effectively reduced.
    - b. Radius of curve shall be at least minimum indicated by NFPA 70.
  5. Cut conduit smooth and square with run and ream to remove rough edges. Cap raceway ends during construction. Clean or replace raceway in which water or foreign matter have accumulated.
  6. Installation in Concrete:
    - a. Install no conduit in concrete unless outside diameter is less than 1/3 of slab, wall, or beam thickness in which it is embedded.
    - b. Position conduits in center of concrete below reinforcing steel, and separated by minimum lateral spacing of three diameters.
    - c. Elbows embedded in concrete shall be rigid steel or IMC and stubouts from concrete slabs shall extend 3 inches (75 mm) minimum before making connection to EMT.
    - d. Separate conduits penetrating structural slabs in buildings by 2 inches (50 mm) minimum.
    - e. Install seal device where underground raceways penetrate concrete building wall.
  7. Installation In Framing:
    - a. Do not bore holes in joists or beams outside center 1/3 of member depth or within 24 inches (600 mm) of bearing points. Do not bore holes in vertical framing members outside center 1/3 of member width.
    - b. Holes shall be one inch (25 mm) diameter maximum.
  8. Conduit And Raceway Support:
    - a. Securely support raceway with approved straps, clamps, or hangers, spaced as required.
    - b. Do not support from mechanical ducts or duct supports without Architect's written approval. Securely mount raceway supports, boxes, and cabinets in an approved manner by:
      - 1) Expansion shields in concrete or solid masonry.
      - 2) Toggle bolts on hollow masonry units.
      - 3) Wood screws on wood.
      - 4) Metal screws on metal.
  9. Prohibited Procedures:
    - a. Use of wooden plugs inserted in concrete or masonry units for mounting raceway, supports, boxes, cabinets, or other equipment.
    - b. Installation of raceway that has been crushed or deformed.
    - c. Use of torches for bending PVC.
    - d. Spray applied PVC cement.
    - e. Boring holes in truss members.
    - f. Notching of structural members.
    - g. Supporting raceway from ceiling system support wires.
    - h. Nail drive straps or tie wire for supporting raceway.
- C. Boxes:
1. Boxes shall be accessible and installed with approved cover.



2. Do not locate device boxes that are on opposite sides of framed walls in the same stud space. In other wall construction, do not install boxes back to back.
  3. Locate boxes so pipes, ducts, or other items do not obstruct outlets.
  4. Install outlets flush with finished surface and level and plumb.
  5. Support switch boxes larger than two-gang with side brackets and steel bar hangers in framed walls.
  6. At time of substantial completion, install blank plates on uncovered outlet boxes that are for future use.
  7. Location:
    - a. Install boxes at door locations on latch side of door, unless explicitly shown otherwise on Contract Drawings. Verify door swings shown on electrical drawings with architectural drawings, and report discrepancies to Architect before rough-in. Distance of box from jamb shall be 6 inches (150 mm) from door jamb.
    - b. Properly center boxes located in walls with respect to doors, panels, furring, trim and consistent with architectural details. Where two or more outlets occur, space them uniformly and in straight lines with each other, if possible.
    - c. Center ceramic tile boxes in tile.
- D. Support factory-fabricated speaker enclosures from structure or ceiling suspension system.

**END OF SECTION**

**SECTION 26 0613****ELECTRICAL EQUIPMENT MOUNTING HEIGHT SCHEDULE****PART 1 - GENERAL: Not Used****PART 2 - PRODUCTS: Not Used****PART 3 - EXECUTION****3.1 INSTALLATION**

- A. Unless otherwise indicated, mount center of outlets or boxes at following heights above finish floor. Refer special conditions to Architect before rough-in and locate outlet under his direction.
- B. Mounting Heights:
1. HVAC:
    - a. Temperature Control Junction Boxes: As indicated on Drawings.
    - b. Thermostats not mounted in occupied space: As indicated on Drawings.
    - c. Remote Temperature Sensors and thermostats mounted in occupied space:
      - 1) Wall-Mounted 50 inches (1 270 mm) to top.
    - d. Indoor Motor Disconnects: 60 inches (1 525 mm).
    - e. Outdoor Motor Disconnects: As indicated on Drawings.
    - f. Motor Controls: 60 inches (1 525 mm).
  2. Electrical:
    - a. Receptacles: 18 inches (450 mm).
    - b. Wall Switches: 42 inches (1 065 mm).

**END OF SECTION**

**SECTION 26 2726****WIRING DEVICES****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install wiring devices complete with plates as described in Contract Documents.
- B. Related Requirements:
  - 1. Section 26 0501: 'Common Electrical Requirements'.
  - 2. Section 27 1501: 'Communications Horizontal Cabling' for cables for telephone and data systems.

**PART 2 - PRODUCTS****2.1 COMPONENTS**

- A. Manufacturers:
  - 1. Manufacturer Contact List:
    - a. Cooper Wiring Devices, Peachtree City, GA [www.cooperwiringdevices.com](http://www.cooperwiringdevices.com).
    - b. General Electric Industrial Systems, Charlotte, NC [www.geindustrial.com](http://www.geindustrial.com).
    - c. Hubbell Building Automation, Austin, TX [www.hubbell-automation.com](http://www.hubbell-automation.com).
    - d. Hubbell Inc, Milford, CT [www.hubbell-wiring.com](http://www.hubbell-wiring.com) or Hubbell Canada Inc, Pickering, ON (800) 263-4622 or (905) 839-4332.
    - e. Hunt Control Systems Inc, Fort Collins, CO [www.huntdimming.com](http://www.huntdimming.com).
    - f. Intermatic Inc, Spring Grove, IL [www.intermatic.com](http://www.intermatic.com).
    - g. IR-TEC America, Inc., Brea, CA [www.irtec.com/en-ira/](http://www.irtec.com/en-ira/).
    - h. Leviton Manufacturing Co, Little Neck, NY [www.leviton.com](http://www.leviton.com) or Leviton Manufacturing of Canada Ltd, Pointe-Claire, QB (800) 461-2002 or (514) 954-1840.
    - i. Legrand, West Hartford, CT [www.legrand.us.com](http://www.legrand.us.com) or Vaughan, ON [www.legrand.ca.com](http://www.legrand.ca.com).
    - j. Lutron Electronics Co Inc, Coopersburg, PA [www.lutron.com](http://www.lutron.com).
    - k. Ortronics, New London, CT [www.ortronics.com](http://www.ortronics.com).
    - l. Paragon Electric Co Inc, Carol Stream, IL [www.icca.invensys.com/paragon](http://www.icca.invensys.com/paragon) or Paragon Electric, Mississauga, ON (800) 951-5526 or (905) 890-5956.
    - m. Pass & Seymour, Syracuse, NY [www.passandseymour.com](http://www.passandseymour.com) or Pass & Seymour Canada Inc, Concord, ON (905) 738-9195.
    - n. Philips Lighting Co, Somerset, NJ [www.lighting.philips.com/nam](http://www.lighting.philips.com/nam) or Philips Lighting Canada, Scarborough, ON (416) 292-3000.
    - o. Red Dot div of Thomas & Betts, Memphis, TN [www.tnbcom](http://www.tnbcom).
    - p. Schneider Electric North America, Palatine, IL [www.schneider-electric.com](http://www.schneider-electric.com) (847) 397-2600.
    - q. Sensorswitch, Wallingford, CT [www.sensorswitch.com](http://www.sensorswitch.com).
    - r. Siemon Company, Watertown, CT [www.siemon.com](http://www.siemon.com).
    - s. Square D Co, Palatine, IL [www.squared.com](http://www.squared.com).
    - t. Suttle, Hector, MN [www.suttleonline.com](http://www.suttleonline.com).
    - u. Tork Inc, Mount Vernon, NY [www.tork.com](http://www.tork.com).
    - v. Watt Stopper Inc, Santa Clara, CA [www.wattstopper.com](http://www.wattstopper.com).
  - 2. Product Options:
    - a. Faces shall be nylon where available.
    - b. Devices of single type shall be from same Manufacturer.

- c. Devices are listed as white. Use white devices on light colored walls, brown on dark colored walls, and black on black walls.
- B. Switches:
1. Standard Style:
    - a. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - 1) 20 AMP, single pole:
        - a) Cooper: 2221V.
        - b) Hubbell: HBL1221-I.
        - c) Pass & Seymour: 20AC1-I.
        - d) Leviton: 1221-2I.
      - 2) Two Pole:
        - a) Cooper: 2222V.
        - b) Hubbell: HBL1222-I.
        - c) Pass & Seymour: 20AC2-I.
        - d) Leviton: 1222-2I.
    2. Exhaust Fan Timer Switches:
      - a. Font:
        - 1) 0-4 Hour, no hold position.
        - 2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
          - a) Intermatic: FDHW.
          - b) Tork: A504HW.
      - b. Custodian Room:
        - 1) 24-hour, in-wall, multiple automatic ON-OFF settings.
        - 2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
          - a) Intermatic: E1020.
          - b) Tork: 701A.
- C. Receptacles:
1. Standard Style:
    - a. 15 AMP, specification grade, back and side wired, self grounding, tamper resistant.
    - b. Verified by UL to meet Fed Spec WC-596F.
    - c. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - 1) Cooper: TR5262.
      - 2) Hubbell: BR20.
      - 3) Leviton: TBR20.
      - 4) Pass & Seymour: TR20.
  2. Ground Fault Circuit Interrupter (GFCI):
    - a. 15 AMP, specification grade.
    - b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - 1) Cooper: GF15W.
      - 2) Hubbell: GF5252WA.
      - 3) Leviton: 8599-W.
      - 4) Pass & Seymour: 1594-W.
- D. Plates:
1. Standard Cover Plates:
    - a. Office / Occupied Areas:
      - 1) Nylon or high impact resistant thermoplastic.
      - 2) Color shall match wiring device.
    - b. All Other: Steel.
    - c. Ganged switches shall have gang plates.
    - d. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
      - 1) Cooper.
      - 2) Hubbell.
      - 3) Leviton.
      - 4) Pass & Seymour.
  2. Weatherproof In-Use Receptacle Covers:
    - a. NEMA 3R rated.
    - b. Cast aluminum.

- c. Compatible with GFCI receptacles.
  - d. Complete with weather resistant gaskets and stainless steel screws.
  - e. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - 1) Hubbell: WP26MH, horizontal; WP26M, vertical.
    - 2) Intermatic: WP1010HMC, horizontal; WP1010MC, vertical.
    - 3) Red Dot: CKMG, horizontal; CKMGV, vertical.
- E. Occupancy Sensors:
- 1. Wall switch, passive infrared type.
    - a. Features include sensitivity and time delay adjustments.
    - b. Manual ON / auto OFF capability.
    - c. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - 1) Cooper Controls: OSW-P-1001-MV-W.
      - 2) IR-TEC America: LbS-700NW.
      - 3) Leviton: ODS10-IDW.
      - 4) Sensorswitch: WSD-V-WH.
      - 5) Watt Stopper: PW-100-W.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install devices flush with walls, straight, and solid to box.

**END OF SECTION**

**SECTION 26 2816****ENCLOSED SWITCHES AND CIRCUIT BREAKERS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install disconnects as described in Contract Documents, except those provided integral with equipment.
- B. Related Requirements:
  - 1. Section 26 0501: Common Electrical Requirements.

**PART 2 - PRODUCTS****2.1 ASSEMBLIES**

- A. Manufacturers:
  - 1. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories.
    - a. Disconnects: Same as Manufacturer of Project's main panelboard.
    - b. Fuses.
      - 1) Cooper Bussmann, Ellisville, IL [www.cooperbussmann.com](http://www.cooperbussmann.com).
      - 2) Edison Fuse, Ellisville, IL (314) 391-3443.
      - 3) Ferraz Shawmut, Newburyport, MA [www.ferrazshawmut.com](http://www.ferrazshawmut.com).
      - 4) Littelfuse Inc, Des Plaines, IL [www.littelfuse.com](http://www.littelfuse.com).
- B. Disconnects:
  - 1. Heavy-duty quick-make, quick-break type, fused or non-fused as indicated on drawings.
  - 2. Provide interlock to prevent opening of door when switch is in ON position.
  - 3. Provide means to lock switch in OFF position with padlock.
  - 4. Disconnects for motor circuits shall be horsepower rated.
  - 5. Disconnects For Furnace Units And Unit Heaters: Provide manual starter with thermal overload relay. Provide overload relay to match motor full load amps.
  - 6. Enclosures:
    - a. Interior: NEMA / CEMA Type 1.
    - b. Exterior: NEMA / CEMA Type 3R.
  - 7. Fuses:
    - a. Fuse fused disconnects with dual-element time delay fuses and equip with rejection type fuse holders.
    - b. Fuses on Project shall be from single manufacturer.

**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. Label disconnects to indicate branch circuit and equipment served. Use 1/16 inch (1.6 mm) thick laminated plastic composition material with contrasting color core. Engraved letters shall be 1/4 inch (6 mm) high. Attach labels with screws.

- B. Install furnace disconnects on furnace at location where it is accessible from front of unit and it does not interfere with unit's operation.

**END OF SECTION**

**SECTION 26 5100****INTERIOR LIGHTING****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install lighting system as described in Contract Documents, complete with lamps.
- B. Related Requirements:
  - 1. Section 26 0501: 'Common Electrical Requirements'.

**1.2 REFERENCES**

- A. Reference Standards:
  - 1. American National Standards Institute (ANSI):
    - a. ANSI C78.377-2017, 'American National Standard for Electric Lamps: Specification for the Chromaticity of Solid State Lighting Products'.
  - 2. Federal Communications Commission (FCC):
    - a. Code of Federal Regulations (CFR):
      - 1) FCC 47 CFR Part 18, 'Industrial, Scientific, and Medical Equipment'.
  - 3. Institute of Electrical and Electronics Engineers (IEEE):
    - a. IEEE C62.41.1-2002, 'Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits'.

**PART 2 - PRODUCTS****2.1 ASSEMBLIES**

- A. Manufacturers:
  - 1. Manufacturer Contact List:
    - a. Advance Transformer Co, Rosemont, IL [www.advancetransformer.com](http://www.advancetransformer.com).
    - b. Cooper Wiring Devices by Eaton, Peachtree City, GA [www.cooperindustries.com](http://www.cooperindustries.com).
    - c. General Electric Lighting, Hendersonville, NC or General Electric Lighting Canada Inc, Mississauga, ON [www.gelighting.com/na](http://www.gelighting.com/na).
    - d. Howard Lighting Products, Laurel, MS [www.howard-ind.com](http://www.howard-ind.com).
    - e. Novitas Inc, Peachtree City, GA [www.novitas.com](http://www.novitas.com).
    - f. Osram Sylvania, Danvers, MA [www.sylvania.com](http://www.sylvania.com) or Osram Sylvania Ltd, Mississauga, ON (905) 673-6171.
    - g. Philips Lighting Co, Somerset, NJ [www.lighting.philips.com/nam](http://www.lighting.philips.com/nam) or Philips Lighting Canada, Scarborough, ON (416) 292-3000.
    - h. Universal Lighting Technologies, Nashville, TN [www.universalballast.com](http://www.universalballast.com).
    - i. Venture Lighting International, Solon, OH [www.venturelighting.com](http://www.venturelighting.com).
    - j. Watt Stopper Inc, Santa Clara, CA [www.wattstopper.com](http://www.wattstopper.com).
    - k. Westinghouse Lighting Corp, Philadelphia, PA [www.westinghouselightbulbs.com](http://www.westinghouselightbulbs.com).
  - 2. Product Options: When several lighting fixtures are specified by name for one use on Drawings, select any one of those specified. Do not mix fixtures from different manufacturers specified for one use.
- B. Materials



1. Lighting Fixtures:
  - a. Type One Acceptable Products:
    - 1) See Fixture Schedule on Drawings for acceptable manufacturers and models.
    - 2) Equals as approved by Architect before bidding. See Section 01 6200.
  - b. See 'Light Fixture Schedule' provided by Owner's Representative.
  - c. LED Lamps and Fixtures:
    - 1) Replacement Lamps shall have minimum efficiency of 70 lm / W per LM 79.
    - 2) Integral LED Lamps shall have minimum efficiency of 90 lm / W per LM 79.
    - 3) Provide minimum rated life of 50,000 per LM 80 and LM 70 standards.
    - 4) Color Temperature: 3000k.
    - 5) Provide full spectrum color index of 65.
- C. Factory Assembly:
  1. Fixtures shall be fully assembled complete with necessary wiring, sockets, lamps, reflectors, ballasts, auxiliaries, plaster frames, recessing boxes, hangers, supports, lenses, diffusers, and other accessories essential for complete working installation.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Interface With Other Work:
  1. In mechanical equipment rooms, coordinate locations of light fixtures with equipment locations to provide proper room illumination without obstruction. Suspend fixtures that must be mounted below pipes, ducts, etc, with chains or other Architect approved method.

### **3.2 ADJUSTMENT**

- A. Repair scratches or nicks on exposed surfaces of fixtures to match original undamaged conditions.

**END OF SECTION**

**DIVISION 31: EARTHWORK**

**31 0500 COMMON WORK RESULTS FOR EARTHWORK**

31 0501 COMMON EARTHWORK REQUIREMENTS

**31 1000 SITE CLEARING**

31 1123 AGGREGATE BASE

END OF TABLE OF CONTENTS



**SECTION 31 0501****COMMON EARTHWORK REQUIREMENTS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited to:
  - 1. General procedures and requirements for earthwork.
- B. Related Requirements:
  - 1. Section 01 1200: 'Multiple Contract Summary' for multiple contracts.
  - 2. Section 32 9001: 'Common Planting Requirements':

**1.2 REFERENCES**

- A. Definitions:
  - 1. Aggregate Base: Layer of granular material immediately below concrete and asphalt paving or miscellaneous site concrete (sidewalks, curbs, etc) and below interior concrete slabs on grade.
  - 2. Base: See aggregate base.
  - 3. Building Grading: sloping of grounds immediately adjacent to building. Proper grading causes water to flow away from a structure. Grading can be accomplished either with machinery or by hand.
  - 4. Compacted Fill: Placement of soils on building site placed and compacted per Contract Documents. Used to replace soils removed during excavation or to fill in low spot on building site.
  - 5. Excavation: Removal of soil from project site or cavity formed by cutting, digging or scooping on project site.
  - 6. Fine Grading (FG): Preparation of subgrade preceding placement of surfacing materials (aggregate base, asphalt or concrete paving, and topsoil) for contour of building site required. Fine Grading is conducted to ensure that earth forms and surfaces have been properly shaped and subgrade has been brought to correct elevations. It is performed after rough grading and placement of compacted fill but before placement of aggregate base or topsoil.
  - 7. Finish Grading: Completed surface elevation of landscaping areas for seeding, sodding, and planting on building site.
  - 8. Natural Grade: Undisturbed natural surface of ground.
  - 9. Rough Grading (RG): Grading, leveling, moving, removal and placement of existing or imported soil to its generally required location and elevation. Cut and fill is part of rough grading.
  - 10. Subgrade (definition varies depending upon stage of construction and context of work being performed):
    - a. Prepared natural soils on which fill, aggregate base, or topsoil is placed.
    - or
    - b. Prepared soils immediately beneath paving or topsoil.
  - 11. Topsoil Placement and Grading: Topsoil placement and finish grading work required to prepare site for installation of landscaping.

**1.3 ADMINISTRATIVE REQUIREMENTS**

- A. Sequencing:
  - 1. General Earthwork:
    - a. Excavation.
    - b. Rough Grading.
    - c. Fill.
    - d. Fine Grading.

- e. Aggregate Base or Topsoil Grading.

## 1.4 QUALITY ASSURANCE

### A. Testing And Inspection:

1. Owner is responsible for Quality Assurance. Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor.
  - a. Owner will employ testing agencies to perform testing and inspection as specified in Field Quality Control in Part 3 of this specification:
    - 1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform the Work in strict accordance with requirements of Contract Documents and perform contractor testing and inspection.
    - 2) See Section 01 1200: 'Multiple Contract Summary'.

## PART 2 - PRODUCTS: Not Used

## PART 3 - EXECUTION

### 3.1 EXAMINATION

#### A. Verification Of Conditions:

1. Forty-eight (48) hours minimum before performing any work on site, contact Blue Stakes of Utah to arrange for utility location services.
2. Perform minor, investigative excavations to verify location of various existing underground facilities at sufficient locations to assure that no conflict with the proposed work exists and sufficient clearance is available to avoid damage to existing facilities.
3. Perform investigative excavating ten (10) days minimum in advance of performing any excavation or underground work.
4. Upon discovery of conflicts or problems with existing facilities, notify Architect by phone or fax within twenty-four (24) hours. Follow telephone or fax notification with letter and diagrams indicating conflict or problem and sufficient measurements and details to evaluate problem.

### 3.2 PREPARATION

#### A. Protection:

1. Spillage:
  - a. Avoid spillage by covering and securing loads when hauling on or adjacent to public streets or highways.
  - b. Remove spillage and sweep, wash, or otherwise clean project, streets, and highways.
2. Dust Control:
  - a. Take precautions necessary to prevent dust nuisance, both on-site and adjacent to public and private properties.
  - b. Correct or repair damage caused by dust.
3. Existing Plants And Features:
  - a. Do not damage tops, trunks, and roots of existing trees and shrubs on site that are intended to remain.
  - b. Do not use heavy equipment within branch spread.
  - c. Interfering branches may be removed only with permission of Architect.
  - d. Do not damage other plants and features that are to remain.

### 3.3 REPAIR / RESTORATION

- A. Adjust existing covers, boxes, and vaults to grade.

- B. Replace broken or damaged covers, boxes, and vaults.
- C. Independently confirm size, location, and number of covers, boxes, and vaults that require adjustment.

### **3.4 FIELD QUALITY CONTROL**

- A. Field Tests And Inspections:
  - 1. Civil and structural field tests, laboratory testing, and inspections are provided by Owner's independent Testing Agency as specified in Section 01 4523 'Testing And Inspection Services':
    - a. Quality Control is sole responsibility of Contractor. Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform The Work or Contractors own Testing and Inspection services.
  - 2. Testing and inspection of earthwork operations is required.
  - 3. Field Tests and Laboratory Tests:
    - a. Owner reserves right to require additional testing to re-affirm suitability of completed work including compacted soils that have been exposed to adverse weather conditions.
  - 4. Field Inspections:
    - a. Notify Architect forty-eight (48) hours before performing excavation or fill work.
    - b. If weather, scheduling, or any other circumstance has interrupted work, notify Architect twenty-four (24) hours minimum before intended resumption of grading or compacting.
- B. Non-Conforming Work:
  - 1. If specified protection precautions are not taken or corrections and repairs not made promptly, Owner may take such steps as may be deemed necessary and deduct costs of such from monies due to Contractor. Such action or lack of action on Owner's part does not relieve Contractor from responsibility for proper protection of The Work.

**END OF SECTION**



**SECTION 31 1123****AGGREGATE BASE****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install the following as described in Contract Documents:
    - a. Aggregate Base:
      - 1) Miscellaneous exterior concrete (sidewalks, curb, gutter and equipment pads).
- B. Related Requirements:
  - 1. Section 01 0000: 'General Requirements':
    - a. Section 01 1200: 'Multiple Contract Summary' for multiple contracts.
    - b. Section 01 4523: 'Testing and Inspecting Services' for testing and inspection, and testing laboratory services for materials, products, and construction methods.
  - 2. Section 03 3111: 'Cast-In-Place Structural Concrete'.
  - 3. Section 31 0501: 'Common Earthwork Requirements' for:
    - a. General procedures and requirements for earthwork.

**1.2 REFERENCES**

- A. Reference Standards:
  - 1. ASTM International:
    - a. ASTM C131/C131M-14, 'Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine'.
    - b. ASTM D1556/D1556M-15, 'Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method'.
    - c. ASTM D1557-12, 'Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>))'.
    - d. ASTM D1883-16, 'Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils'.
    - e. ASTM D2167-15, 'Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method'.
    - f. ASTM D2419-14, 'Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate'.
    - g. ASTM D4318-17, 'Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils'.
    - h. ASTM D6938-17, 'Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)'.

**1.3 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-Installation Conferences:
  - 1. Participate in MANADORY pre-installation conference as specified in Section 31 0501.
  - 2. In addition to agenda items specified in Section 01 3100 and Section 31 0501, review following:
    - a. Review requirements and frequency of testing and inspections.
    - b. Review aggregate base installation requirements.
    - c. Review proposed miscellaneous exterior concrete schedule.
    - d. Review Section 01 4523 for Testing and Inspection administrative requirements and responsibilities and Field Quality Control tests and inspections required of this section.
      - 1) Review frequency of testing and inspections.



- B. Sequencing:
  - 1. Aggregate Base:
    - a. Install aggregate base at location shown in Contract Drawings.
  - 2. Concrete Slab is installed.
- C. Scheduling:
  - 1. Miscellaneous exterior concrete:
    - a. Notify Testing Agency and Architect twenty-four (24) hours minimum before placing concrete for exterior site work concrete (sidewalks, curbs, gutters, etc.), footings, foundation walls, and building slabs to allow inspection of aggregate base.

#### 1.4 SUBMITTALS

- A. Closeout Submittals:
  - 1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    - a. Record Documentation:
      - 1) Testing and Inspection Reports:
        - a) Testing Agency Testing and Inspecting Reports of aggregate base.

#### 1.5 QUALITY ASSURANCE

- A. Testing And Inspection:
  - 1. Owner will provide Testing and Inspection for aggregate base:
    - a. Owner is responsible for Quality Assurance. Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor.
    - b. Owner will employ testing agencies to perform testing and inspection for aggregate base as specified in Field Quality Control in Part 3 of this specification.
      - 1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform the Work in strict accordance with requirements of Contract Documents and perform contractor testing and inspection.
      - 2) See Section 01 1200: 'Multiple Contract Summary'.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery And Acceptance Requirements:
  - 1. Materials shall be delivered in original, unopened packages with labels intact.

#### 1.7 FIELD CONDITIONS

- A. Ambient Conditions:
  - 1. Do not perform work during unfavorable conditions as specified below:
    - a. Aggregate Base:
      - 1) Presence of free surface water.
      - 2) Over-saturated sub base materials.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Aggregate Base:
  - 1. Under Exterior Concrete (Section 03 3111 'Cast-In-Place Structural Concrete') excluding Concrete Paving):
    - a. New Aggregate Base:

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Stockpiles:
  - 1. Provide area for each stockpile of adequate size, reasonably uniform in cross-section, well drained, and cleared of foreign materials.
  - 2. Locate piles so that there is no contamination by foreign material and no intermingling of aggregates from adjacent piles. Do not use steel-tracked equipment on stockpiles.
  - 3. Do not store aggregates from different sources, geological classifications, or of different gradings in stockpiles near each other unless bulkhead is placed between different materials.
  - 4. Do not use washed aggregates sooner than twenty-four (24) hours after washing or until surplus water has drained out and material has uniform moisture content.
  - 5. Do not stockpile higher than **15 feet (4.57 m)**. Cover or otherwise protect stockpiles for use in HMA to prevent buildup of moisture.
- B. Surface Preparation (Miscellaneous Exterior Concrete):
  - 1. Subgrade:
    - a. Finish grade to grades required by Contract Documents.
    - b. Compact subgrade as specified in Section 31 2323.

### 3.2 INSTALLATION

- A. Aggregate Base:
  - 1. General:
    - a. Do not place aggregate base material when subgrade is frozen or unstable.
    - b. Spread aggregate base material with equipment except in limited or restricted areas where use of hand spreading is allowed.
    - c. Spread aggregate base material in manner that does not break down material and eliminates segregation, ruts, and ridges.
    - d. Correct damage to aggregate base caused by construction activities and maintain corrected aggregate base until subsequent course is placed.
    - e. Do not allow traffic on aggregate base.
    - f. Remove all standing storm water.
  - 2. Under miscellaneous exterior concrete aggregate base:
    - a. Except under mow strips, place **4 inches (100 mm)** minimum of aggregate base, level, and compact as specified in Section 31 2323.

### 3.3 FIELD QUALITY CONTROL

- A. Field Tests And Inspections:
  - 1. Civil and structural field tests, laboratory testing, and inspections are provided by Owner's independent Testing Agency as specified in Section 01 4523 'Testing And Inspection Services':
    - a. Quality Control is sole responsibility of Contractor.
      - 1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
        - a) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.
  - 2. Aggregate Base:
    - a. Miscellaneous exterior concrete areas:
      - 1) Testing Agency shall provide testing and inspection for exterior aggregate base.
      - 2) Number of tests may vary at discretion of Architect.
      - 3) Testing Agency will test compaction of base in place according to ASTM D1556/D1556M, ASTM D2167, and ASTM D6938, as applicable. Tests will be performed at following frequency:

- a) Sitework Areas: One test for every 10,000 sq. ft. (930 sq. m) or less of exterior pads area but no fewer than three tests.

**END OF SECTION**

**DIVISION 32: EXTERIOR IMPROVEMENTS**

**32 8000 IRRIGATION**

32 8423 UNDERGROUND SPRINKLERS

**32 9000 PLANTING**

32 9001 COMMON PLANTING REQUIREMENTS

32 9300 PLANTS

END OF TABLE OF CONTENTS



**SECTION 32 8423****UNDERGROUND SPRINKLERS – NO CONTROLLERS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
1. Furnish and install landscape irrigation system as described in Contract Documents complete with accessories necessary for proper function.
- B. Related Requirements:
1. Section 32 9001: 'Common Planting Requirements'.
  2. Section 32 9300: 'Plants'.

**1.2 REFERENCES**

- A. Definitions:
1. Automated Self Flushing Filter: Filter located immediately downstream from point of connection in-lieu of backflow prevention device for irrigation systems that utilize non-potable, secondary and/or reclaimed water that is automatically self flushing to control unwanted debris from infiltrating remaining irrigation system.
  2. Dielectric Fittings: Special type of fitting used between dissimilar metals to prevent galvanic action from causing corrosion failure.
  3. High Wind Area: As defined in this specification, area with average sustained wind speed of over **7.5 mph (12 km/hr)**.
  4. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
  5. Landscape Management Plan (LMP): See Section 32 9001 for definition.
  6. Lateral Line: Downstream from electric control valves to application devices, heads and emitters. Piping or tubing is under pressure during flow. In areas where potable or secondary water are used, line shall be white. In areas where non-potable or reclaimed water are used, line shall be purple.
  7. Main Line: Downstream from point of connection to electric control valves. Piping is under water-distribution-system pressure when activated by master valve or hydrometer. In areas where potable or secondary water are used, line shall be white. In areas where non-potable or reclaimed water are used, line shall be purple.
  8. Peak Flow: Maximum required flow for given month based on six (6) day week, nine (9) hour day watering window to be used for irrigation system design and to be used in hydraulic analysis.
  9. Plant Establishment Period: See Section 32 9001 for definition.
  10. Point of Connection: Location where water enters irrigation system.
  11. Static Water Pressure: Pressure at point of connection when system is not operable.
  12. Source Pressure Test: Test to determine water source pressure.
  13. System Pressure Test: Test to evaluate system when pressurized.
  14. Two-Wire Path: Conducts power to solenoid valves, and also conducts communications signals from Controller to each device on system.
  15. Working Pressure: Pressure at point of connection when system is operable.
- B. Reference Standards:
1. ASTM International:
    - a. ASTM D2564-12, 'Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems'.
    - b. ASTM F656-15, 'Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings'.

### 1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Provide Coordination for required tests and inspections as described under Field Quality Control in Part 3 EXECUTION for following:
    - a. Manufacturer's Field Service: Provide necessary manufacturer's field service.
    - b. Substantial Completion Walkthrough: In presence of Landscape Architect or designated Representative(s), plan and provide walk through after completion of irrigation system.
    - c. Landscape Final Acceptance: Inspection, no less than thirty (30) days following substantial completion, when all work has been completed, demonstrated, and approved by Landscape Architect. Coordinate with Section 32 9000.
- B. Sequencing:
  - 1. Install sleeves and conduit before installation of cast-in-place concrete site elements and paving.

### 1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. General:
    - a. Work and materials shall be in accordance with latest rules and regulations, and other applicable state or local laws.
    - b. Nothing in Contract Documents is to be construed to permit work not conforming to these codes.
- B. Qualifications: Requirements of Section 01 4301 applies, but not limited to following:
  - 1. Irrigation Subcontractor:
    - a. Company specializing in performing work of this section.
    - b. Minimum five (5) years experience in irrigation sprinkler installations.
    - c. Minimum five (5) satisfactorily completed irrigation sprinkler installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
    - d. Use trained personnel familiar with required irrigation sprinkler procedures and with Contract Documents.
    - e. Foreman or supervisor required to attend pre-installation conference.
    - f. Upon request, submit documentation.
  - 2. Irrigation Installer:
    - a. Perform installation under direction of foreman or supervisor.
    - b. Minimum three (3) years experience in irrigation sprinkler installations similar in size, scope, and complexity.
    - c. Upon request, submit documentation.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Storage And Handling Requirements:
  - 1. Protect materials from damage and prolonged exposure to sunlight..

## PART 2 - PRODUCTS

### 2.1 SYSTEM

- A. Manufacturers:
  - 1. Manufacturer Contact List:
    - a. 3M, Austin, TX [www.3m.com/elpd](http://www.3m.com/elpd).
    - b. Action Machining Inc, Bountiful, UT [www.actionfilters.com](http://www.actionfilters.com).
    - c. Amiad [www.amiadusa.com](http://www.amiadusa.com).
    - d. Apollo Valves by Conbraco Industries, Matthews, NC [www.apollovalves.com](http://www.apollovalves.com).

- e. Carson by Oldcastle Enclosure Solutions, Auburn, WA [www.oldcastleenclosures.com](http://www.oldcastleenclosures.com).
  - f. GPH Irrigation Products, Fontana, CA [www.gphirrigation.com](http://www.gphirrigation.com).
  - g. Harrington Corporation (Harco), Lynchburg, VA [www.harcofittings.com](http://www.harcofittings.com).
  - h. Hunter Industries, San Marcos, CA [www.hunterindustries.com](http://www.hunterindustries.com).
  - i. HydroRain, North Salt Lake, UT [www.hydorain.com](http://www.hydorain.com).
  - j. King Innovation, St Charles, MO [www.kinginovation.com](http://www.kinginovation.com).
  - k. IPS Corporation, Compton, CA [www.ipscorp.com](http://www.ipscorp.com).
  - l. Leemco, Colton, CA [www.leemco.com](http://www.leemco.com).
  - m. Netafim, Inc. [www.netafimusa.com](http://www.netafimusa.com).
  - n. Nibco Inc, Elkhart, IN [www.nibco.com](http://www.nibco.com).
  - o. Northstar Industries, LLC, Riverside, CA [www.suresplice.com](http://www.suresplice.com).
  - p. Orbit Irrigation Products, Inc. Bountiful, UT [www.orbitonline.com](http://www.orbitonline.com).
  - q. Paige Electric, Union, NJ [www.paigewire.com](http://www.paigewire.com).
  - r. Rain Bird Sprinkler Manufacturing Corp, Glendora, CA [www.rainbird.com](http://www.rainbird.com).
  - s. Salco by Weathermatic Irrigation Products, Garland, TX [www.weathermatic.com](http://www.weathermatic.com).
  - t. Toro Company, Irrigation Div, Riverside, CA [www.toro.com](http://www.toro.com).
  - u. T. Christy Enterprises, Inc. (Christy's), Anaheim, CA [www.tchristy.com](http://www.tchristy.com).
  - v. VAF Filtration Systems, Arvada, CO [www.vafusa.com](http://www.vafusa.com).
  - w. Weathermatic Irrigation Products, Garland, TX [www.weathermatic.com](http://www.weathermatic.com).
  - x. Wilkins a Zurn Company, Paso Robles, CA [www.zurn.com](http://www.zurn.com).
- B. Materials:
1. Rock-Free Soil:
    - a. For use as backfill around PVC pipe.
  2. Native Material:
    - a. Soil having rocks no larger than **1/2 inch (13 mm)** in any dimension.
  3. Pea Gravel:
    - a. For use around drains, valves, and quick couplers.
    - b. **1/2 inch (13 mm)** maximum dimension, washed rock.
  4. Sand: Fine granular material naturally produced by rock disintegration and free from organic material, mica, loam, clay, and other deleterious substances.
  5. Native Material: Soil native to project site free of wood and other deleterious materials and rocks over **1-1/2 inches (38 mm)**.
  6. Topsoil:
    - a. Achieve depths as described in Section 32 9122.
  7. Pipe, Pipe Fittings, And Connections:
    - a. General:
      - 1) Pipe shall be continuously and permanently marked with Manufacturer's name, size, schedule, type, and working pressure.
      - 2) Pipe sizes shown on Contract Drawings are minimum. Larger sizes may be substituted at no additional cost to Owner.
    - b. Piping:
      - 1) Main Line: Schedule 40 PVC.
      - 2) Lateral Lines: Schedule 40 PVC.
      - 3) Backflow Assembly Piping: Galvanized steel upstream of first dielectric union. Brass next to backflow preventer. Galvanized steel downstream of second dielectric union.
      - 4) Quick Coupler Piping: Galvanized steel.
    - c. Fittings: Same material as pipe, except where detailed otherwise.
      - 1) Fittings **3 inch (76 mm)** or larger: Harco or Leemco of matching size.
      - 2) Use dielectric union fittings between dissimilar metal pipes and fittings.
    - d. Sleeves:
      - 1) Under Parking Area And Driveway Paving: Schedule 40 PVC Pipe.
      - 2) All Other: Class 200 PVC Pipe.
      - 3) Sleeve diameter shall be two (2) times larger than pipe installed in sleeve.
  8. Sprinkler Heads:
    - a. Each type of head shall be product of single manufacturer.
    - b. Shrub Head Bubblers:
      - 1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
        - a) Hunter: 2, 4, 6 Short Radius, S-8A, S-16A series (stream spray), PCN, PCB, MSBN, AFB, 5-CST-B series.



- b) Rainbird: 1400 series pressure compensating.
- c) Weathermatic: 102 Series, 106 series.
- c. Spray Heads in Shrub and Ground Cover Areas:
  - 1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - a) Hunter: PR30 or shrub adapter on Schedule 80 PVC nipple. Supply with MPR nozzles. CV optional.
    - b) Hydro-Rain: 200 series, 04, 06, 12 Model PRHS with shrub adapter No. 94525.
    - c) Rainbird: 1804, 1806, or 1812 PRS Series or PA-8S shrub adapter. Supply with MPR, U-series, or HE-VAN series nozzles. SAM optional.
    - d) Toro: 570 ZPRX MPR series with shrub adapter and MPR plus or Precision Series Spray nozzles.
    - e) Weathermatic: LX4 or LX6 series or LXS (shrub adapter). Supply with MPR nozzle.
- d. Spray Heads in Lawn Areas:
  - 1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - a) Hunter: PRS30, Pro-Spray Series with MPR nozzles, optional with CV.
    - b) Hydro-Rain: HRS 200 Series, 04, 06 Model PRHS with MPR nozzle.
    - c) Rainbird: 1804 or 1806 Series with MPR, U-Series, or HE-VAN nozzles. SAM optional.
    - d) Toro: 570 ZPRX series with MPR plus or Precision Series Spray nozzles.
    - e) Weathermatic: LX4 or LX6 series with MPR nozzles.
- e. Rotary Stream Heads in Lawn and Shrub Areas:
  - 1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - a) Hunter: PRS40 with MP Rotator nozzle.
    - b) Rainbird: 1806-SAM-P45 with R-VAN nozzles.
    - c) Toro: 570 ZPRX Series with Precision Series Rotating nozzles.
- f. Rotor Pop-ups:
  - 1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - a) Hunter: PGS Series (Shrub), PGP Series (17 to 46 feet), I-10 Series (Shrub) I-20 Series (17 to 46 feet), I-25 or I-40 Series (40 to 76 feet).
    - b) Rainbird: 5000/5000 plus MPR series, (25'-35'), 5500 Series (33'-55') 8005 Series (39'-81').
    - c) Toro: Mini 8 series (20-35 feet), T5P-RS (28'-50') series with 5 inch pop.
    - d) Weathermatic: T3 (23'-61'), CT-70 series, (49'-74').
- 9. Sprinkler Risers:
  - a. Spray Heads (Pre-Manufactured Swing Assemblies):
    - 1) Type Two Acceptable Products:
      - a) Hunter: SJ-512 (12 inch (305 mm) x 1/2 inch (12.7 mm)) thread) or SJ-7512 (12 inch (305 mm) x 3/4 inch (19 mm) x 1/2 inch (12.7 mm)) thread).
      - b) Rain Bird model SA125050.
      - c) Hydrorain: Blu-lock model BLJ-050-MC-1..
      - d) Equal as approved by Architect before use. See Section 01 6200.
  - b. Spray Heads (Field Manufactured Assemblies):
    - 1) Three (3) schedule 40 street ells or Marlex street ells connected to lateral tee to form an adjustable riser or pop-up riser as detailed.
    - 2) Risers for sprinkler heads 14 inches (355 mm) long minimum and 24 inches (610 mm) maximum.
      - a) Type Two Acceptable Products:
        - (1) Hunter: FLEXsg tubing with HSBE spiral barbed fittings.
        - (2) Hydro-Rain: Blu-lock Swing pipe & fittings.
        - (3) Rainbird: Swing Pipe with barbed fittings.
        - (4) Toro: Super Funny Pipe with barbed fittings, SPFA-5125, SPFA-51275.
        - (5) Equal as approved by Architect before installation. See Section 01 6200.
  - c. Rotor Pop-Up Sprinklers (Pre-Manufactured Assemblies):
    - 1) Type Two Acceptable Products:
      - a) 3/4 inch (19 mm) rotor pop-up sprinklers shall have an adjustable pre-assembled swing assembly riser. Swing assemblies shall be 3/4 inch x 12 inch (19 mm x 300 mm) and shall be threaded both ends. Swing assemblies shall be:
        - (1) Blu-lock: Model BLJ-075-TT-12.
        - (2) Rain Bird: Model TSJ-12075.

- (3) Hunter: SJ-712 12 inch (305 mm) thread.
  - b) 1 inch (25 mm) inlet rotor pop-up sprinklers shall have an adjustable pre-assembled double swing joint riser. Swing joints shall be 1 inch x 12 inch (25 mm x 300 mm) and shall be threaded both ends. Swing joint riser shall be:
    - (1) Rain Bird: Model TSJ-12075.
    - 2) Equal as approved by Architect before installation:
  - d. Rotor Pop-Up Sprinkler Heads (Field Manufactured Assemblies):
    - 1) Pop-up rotor sprinkler heads shall have adjustable riser assembly, three (3) ell swing joint assembly, unless detailed otherwise on Contract Drawings:
      - a) These swing joint fittings shall be of schedule 40 PVC plastic and nipples schedule 80 gray PVC unless otherwise designated on Contract Drawings.
      - b) Horizontal nipple parallel to side of lateral line shall be 8 inches (200 mm) long minimum.
      - c) All other nipples on swing joint riser shall be of length required for proper installation of sprinkler heads.
10. Control Wiring:
- a. Control Wiring:
    - 1) Wiring:
      - a) Traditional control wire shall be UF-UL listed, color coded PE insulated copper conductor direct burial size 14. For wire runs exceeding 3,300 feet (1 005.84 meter), use 12 AWG wire. Do not use green color-coded wire.
      - b) Aside from connectivity to automatic control valves, this material will be used to connect to master valve portion of hydrometer.
    - 2) Communication:
      - a) Communication wire between controller and flow sensor portion of hydrometer to be Paige Electric PE-39 (WeatherTRAK) or PE-54 (Rain Master). Run underground communication wire in gray electrical conduit.
      - b) Class Two Quality Standards. See Section 01 6200:
        - (1) Paige Electric Cadweld Connection.
    - 3) Waterproof Wire Connectors:
      - a) Control wire connections shall consist of properly-sized wire nut inserted in waterproof grease cap:
      - b) Type Two Acceptable Products:
        - (1) DBY or DBR by 3M.
        - (2) 'One Step' 20111SP by King Innovation.
        - (3) DB 57905, 57505 by Orbit.
        - (4) Equal as approved by Architect before installation. See Section 01 6200.
  - b. Conduit:
    - 1) Exterior applications or inside mechanical shed:
      - a) Galvanized IMC. Where in contact with earth or concrete, wrap galvanized IMC conduit and fittings completely with vinyl tape.
    - 2) Controller grounding wire conduit: commercial grade PVC Sch. 40 grey conduit.
    - 3) In-ground: commercial grade grey conduit.
    - 4) Size conduit as follows:
    - 5) Traditional Wiring:

Galvanized IMC Conduit						
Wire Size (AWG)	Number of Wires					
14	7	13	22	32	47	67
12	6	8	18	25	38	59
Conduit Size	3/4 inch (19 mm)	1 inch (25 mm)	1 1/4 inch (32 mm)	1 1/2 inch (38 mm)	2 inch (50 mm)	2 1/2 inch (64 mm)

PVC Sch. 40 Conduit						
Wire Size (AWG)	Number of Wires					
14	6	11	20	29	43	61
12	5	7	17	23	35	54
Conduit Size	3/4 inch (19 mm)	1 inch (25 mm)	1 1/4 inch (32 mm)	1 1/2 inch (38 mm)	2 inch (50 mm)	2 1/2 inch (64 mm)
PVC Sch. 80 Conduit						
Wire Size (AWG)	Number of Wires					
14	5	9	17	24	39	55
12	4	6	14	19	32	49
Conduit Size	3/4 inch (19 mm)	1 inch (25 mm)	1 1/4 inch (32 mm)	1 1/2 inch (38 mm)	2 inch (50 mm)	2 1/2 inch (64 mm)

11. Valves:

- a. Manual Drain Valves:
  - 1) Brass ball valve with 'T' handle on main lines and in valve boxes on lateral lines.
  - 2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - a) Apollo Valves: 78-621-01 Series ball valve, 3/4 inch (19 mm).
- b. Automatic Valves:
  - 1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - a) Hunter: PGV or ICV series. If required, provide with Accu-sync pressure regulator.
    - b) Hydro-Rain: HRB series.
    - c) Rainbird: DVFUU Series, PGA series, PEB series, PESB series. If required, provide with Accu-sync pressure regulator.
    - d) Toro: 250/260 Series.
    - e) Weathermatic: 21000 CR series, 11000 CR series.
- c. Isolation Valves:
  - 1) PVC ball valves, size to match pipe size (use in warm climates- eco-regions 8.2, 10.2, 11.0, 12.0, 13.0, 14.0, 15.0).
  - 2) Non-rising stem gate valve, size to match pipe size (use in cold, northern climates- eco-regions 1.0, 5.0, 6.0, 7.0, 9.1, 9.2, and 10.1).
  - 3) Class Two Quality Standards. See Section 01 6200:
    - a) Nibco: 4660T (warm climates).
    - b) Nibco: T-113 (cold, northern climates).
- d. Quick Coupling Valves and Keys:
  - 1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - a) Hunter: HQ-33D Series with RC or with HK-33 and HSO swivel.
    - b) Orbit: 51029 with 51031 brass key.
    - c) Rainbird: 33DRC, 33DLRC, 33DK with SH-O swivel.
    - d) Toro: 100 Series (formally 470 Series) with single lug key.

12. Valve Accessories:

- a. Valve manifolds:
  - 1) Type Two Acceptable Products.
    - a) Action Machining: 1800 Series, Models 18001, 18001-1-5, and 18001-2.0, 1, 1-1/2, and 2 inch (25, 38, and 50 mm) sizes.
    - b) Hydro-Rain: HRM Series.
    - c) Equals as approved by Architect before use. See Section 01 6200.

- b. Valve Boxes And Extensions:
    - 1) Lid Colors:
      - a) Green: Lawn areas (potable and secondary water).
      - b) Tan: Bare soil and rock areas (potable and secondary water).
      - c) Purple: Reclaimed water.
    - 2) Type Two Acceptable Products:
      - a) Carson:
        - (1) 12 Inch (300 mm) Model 1324-12.
        - (2) 12 Inch (300 mm) Model 1419-12.
        - (3) 10 Inch (255 mm) Model 0910.
      - b) Equal as approved by Architect before use. See Section 01 6200.
  - c. Valve ID tags:
    - 1) Type Two Acceptable Products:
      - a) Christy's: Stamped ID tag: 2.25"x2.7" yellow plastic tag with alpha-numeric labeling matching zone. Contact Christy's for local supplier.
      - b) Equal as approved by Architect before use. See Section 01 6200.
  - d. Valve Box Supports:
    - 1) Standard size fired clay paving bricks without holes.
    - 2) Standard size 6 inch x 8 inch x 16 inch (150 mm x 200 mm x 400 mm) CMU Block.
13. Drip System:
- a. Drip Valve Assembly (Coordinate zone size with hydrometer limits):
    - 1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - a) Hunter:
        - (1) 0.5 to 15 GPM: ICZ-101LF. Provide with line-size matching ball valve in separate round valve box.
        - (2) 2 to 20 GPM: ICZ-101. Provide with line-size matching ball valve in separate round valve box.
        - (3) 20 to 60 GPM: ICZ-151. Provide with line-size matching ball valve in separate round valve box.
        - (4) 20 to 60 GPM: ICZ-151-XL. Provide with line-size matching ball valve in separate round valve box.
      - b) Netafim:
        - (1) 0.25 to 4.4 GPM: LVCZ8010075-LF. Select disc or screen filter. Provide with line-size matching ball valve in separate round valve box.
        - (2) 4.5 to 17.6 GPM: LVCZ10075-HF. Select disc or screen filter. Provide with line-size matching ball valve in separate round valve box.
        - (3) 11 to 30 GPM: LVCZ150. Select disc or screen filter. Provide with line-size matching ball valve in separate round valve box.
      - c) Rainbird:
        - (4) 0.3 to 20 GPM: XCZ-100-PRB COM. Select screen size.
        - (5) 0.3 to 20 GPM: XCZ-100-PRBR. Select screen size and provide with line-size matching ball valve.
        - (6) 15 to 62 GPM: XCZ-150-LCS. Provide with line-size matching ball valve in separate round valve box.
        - (7) 15 to 62 GPM: XCZ-150-LCDR. Reclaimed water kit. Provide with line-size matching ball valve in separate round valve box.
      - d) Toro:
        - (1) 0.1 to 8 GPM: DZK-700-1-LF: Provide with line-size matching ball valve.
        - (2) 2 to 20 GPM: DZK-700-1-MF: Provide with line-size matching ball valve.
  - b. Distribution Tubing (from lateral lines to emitter):
    - 1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - a) GPH: GPST IH Series, pre-assembled flexible riser w/fittings (size as required).
      - b) Salco: IH Series, pre-assembled flexible riser with fittings (size as required).
      - c) Rainbird: SPX swing pipe with barbed fittings.
      - d) Hunter: SJ Series with barbed fittings.
  - c. Drip Emitters:
    - 1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - a) GPH: GPST-CV Series (2, 4, 6, 8, 10 gph emitters).
      - b) Rainbird: XBT Series and PCT Series (2, 5, 7, 10 gph emitters).
      - c) Salco: PST-CV Series (2, 4 gph emitters).

- d. Indicator Emitter:
    - 1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - a) Tree drip indicator:
        - (1) Rainbird: XB-10PC with barbed fittings, DBC-025 diffuser cap, TS-025 stake, and XQ 1/4 inch (6.4 mm) tubing.
  - e. Distribution Tubing (from lateral lines to in-line emitter tubing).
    - 1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - a) Flexible polyethylene pipe.
  - f. In-Line Emitter Tubing:
    - 1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      - a) Hunter: PLD Series air/vacuum relief valves, barb shut-off valves, and 17 mm barbed fittings.
      - b) Rainbird: XFCV or XFS drip line, 1/2 inch (12.7 mm) air relief valves, flush valves, and XF series insert fittings.
      - c) Netafim: Techline CV tubing, flush valves, and fittings.
  - g. Valve Boxes and Extensions:
    - 1) Lid Colors:
      - a) Green: Lawn areas (potable and secondary water).
      - b) Tan: Bare soil and rock areas (potable and secondary water).
      - c) Purple: Reclaimed water.
    - 2) Type Two Acceptable Products:
      - a) Carson:
        - (1) 12 Inch (300 mm) Model 1324-12.
        - (2) 12 Inch (300 mm) Model 1220-12.
        - (3) 12 Inch (300 mm) Model 1419-12.
        - (4) 10 Inch (255 mm) Model 0910.
      - b) Equal as approved by Architect before use. See Section 01 6200.
  - h. Valve ID Tags:
    - 1) Type Two Acceptable Products:
      - a) Christy's: Stamped ID tag: 2.25"x2.7" yellow plastic tag with alpha-numeric labeling matching zone. Contact Christy's for local supplier.
      - b) Equal as approved by Architect before use. See Section 01 6200.
  - i. Valve Box Supports:
    - 1) Standard size fired clay paving bricks without holes.
    - 2) Standard size 6 inch x 8 inch x 16 inch (150 mm x 200 mm x 400 mm) CMU Block.
14. Solvent Cement:
- a. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    - 1) Primer:
      - a) Meet ASTM F656 standard and applicable sections of latest edition of 'Uniform Plumbing Code'.
      - b) Meet NSF/ANSI standard for use on potable water applications.
      - c) Low VOC emissions and compliant with LEED.
      - d) Product: Weld-On P-70 primer by IPS.
    - 2) PVC Solvent Cement:
      - a) Heavy bodied, medium setting, high strength:
        - (1) Meet ASTM D2564 standard and applicable sections of latest edition of 'Uniform Plumbing Code'.
        - (2) Meet NSF/ANSI standard for use on potable water applications.
        - (3) Meet CSA standards for use in pressure and non-pressure potable water applications.
        - (4) Low VOC emissions and compliant with LEED.
        - (5) Product: Weld-On 711 Low VOC PVC Cement by IPS.
      - b) Flexible, medium bodied, fast setting, high strength (flexible pipe only):
        - (1) Meet ASTM D2564 standard and applicable sections of latest edition of 'Uniform Plumbing Code'.
        - (2) Meet NSF/ANSI standard for use on potable water applications.
        - (3) Low VOC emissions and compliant with LEED.
        - (4) Product: Weld-On 795 Low VOC Flex PVC Cement by IPS.
15. Other Components:
- a. Weed Barrier:

- 1) Type Two Acceptable Products:
  - a) DeWitt 4.1 oz (116 g) 20 year woven polypropylene weed barrier
  - b) Hanes Pro-Platinum 4.1 oz (116 g) 20 year woven polypropylene weed barrier.
  - c) Equal as approved by Landscape Architect before bidding. See Section 01 6200.
- b. Recommended by Manufacturer and subject to Architect's review and approval before installation.
- c. Provide components necessary to complete system and make operational.

## PART 3 - EXECUTION

### 3.1 INSTALLERS

- A. Acceptable Installers:
  1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

### 3.2 PREPARATION

- A. Protection:
  1. Protection Of In-Place Conditions:
    - a. Repair or replace work damaged during course of Work at no additional cost to Owner. If damaged work is new, installer of original work shall perform repair or replacement.
    - b. Do not cut existing tree roots measuring over 2 inches (50 mm) in diameter in order to install irrigation lines.
- B. Surface Preparation:
  1. Layout of Irrigation Heads:
    - a. Location of heads and piping shown on Contract Drawings is approximate. Actual placement may vary slightly as is required to achieve full, even coverage without spraying onto buildings, sidewalks, fences, etc.
    - b. During layout, consult with Architect to verify proper placement and make recommendations, where revisions are advisable.
    - c. Minor adjustments in system layout will be permitted to avoid existing fixed obstructions.
    - d. Make certain changes from Contract Documents are shown on Record Drawings.

### 3.3 INSTALLATION

- A. Trenching And Backfilling:
  1. Pulling of pipe is not permitted.
  2. Excavate trenches to specified depth. Remove rocks larger than 1-1/2 inch (38 mm) in any direction from bottom of trench. Separate out rocks larger than 1-1/2 inch (38 mm) in any direction uncovered in trenching operation from excavated material and remove from areas to receive landscaping.
  3. Do not cover pressure main, irrigation pipe, or fittings until Architect has inspected and approved system.
- B. Sleeving:
  1. Sleeve water lines and control wires under walks and paving. Extend sleeves 6 inches (150 mm) minimum beyond walk or pavement edge. Cover sleeve ends until pipes and wires are installed to keep sleeve clean and free of dirt and debris.
  2. Position sleeves with respect to buildings and other obstructions so pipe can be easily removed.
- C. Grades And Draining:
  1. In localities where winterization is required, grade piping so system can be completely drained or blown out with compressed air. If system is not designed to be blown out with compressed air:
    - a. Slope pipe to drain to control valve box where possible.

- b. Where this is not possible, slope pipe to minimum number of low points. At these low points, install:
    - 1) **3/4 inch (19 mm)** brass ball valve for manual drain. Do not use automatic drain valves.
    - 2) Install **2 inch (50 mm)** Class 200 PVC pipe over top of drain and cut at finish grade.
    - 3) Provide rubber valve cap marker.
    - 4) Provide **one cu ft (0.03 cu m)** pea gravel sump at outlet of each drain.
  - c. Slope pipes under parking areas or driveways to drain outside these areas.
  - d. Provide and install quick-coupling valve or valves in location for easy blowout of entire system. Install quick coupler valves with **2 lineal feet (0.60 m)** minimum of galvanized pipe between valve and main line.
- D. Installation of Pipe:
- 1. Install pipe in manner to provide for expansion and contraction as recommended by Manufacturer.
  - 2. Unless otherwise indicated on Contract Drawings, install main lines with minimum cover of **18 inches (450 mm)** based on finished grade. Install lateral lines, including those connecting drip tubing, with minimum of **12 inches (300 mm)** of cover based on finish grade.
  - 3. Install pipe and wires under driveways or parking areas in specified sleeves **18 inches (450 mm)** below finish grade or as shown on Contract Drawings.
  - 4. Locate pipe so no sprinkler head will be closer than **12 inches (300 mm)** from building foundation.
  - 5. Cut plastic pipe square. Remove burrs at cut ends before installation so unobstructed flow will result.
  - 6. Make solvent weld joints as follows:
    - a. Do not make solvent weld joints if ambient temperature is below **35 deg F (2 deg C)**.
    - b. Clean mating pipe and fitting with clean, dry cloth and apply one (1) coat of primer to each surface.
    - c. Apply uniform coat of solvent cement to outside of pipe.
    - d. Apply solvent cement to fitting in similar manner.
    - e. Insert pipe completely into fitting.
    - f. Give pipe or fitting quarter turn to insure even distribution of solvent and make sure pipe is inserted to full depth of fitting socket.
    - g. Allow joints to set at least twenty-four (24) hours before applying pressure to PVC pipe.
  - 7. Tape threaded connections with teflon tape.
  - 8. Isolation Valves:
    - a. Install as detailed and per Manufacturers recommendations.
  - 9. If pipe is larger than **3 inches (75 mm)**, install joint restraints wherever change of direction occurs on PVC main lines.
- E. Control Valves And Control Valve Wiring:
- 1. Install valves in plastic boxes with reinforced heavy-duty plastic covers. Locate valve boxes within **12 inches (300 mm)** to **24 inches (600 mm)** of sidewalks and shrub bed edges with tops at finish grade. Do not install more than one (1) valve in single box.
  - 2. Install equipment for ease of removal.
  - 3. Place **3 inches (75 mm)** minimum of pea gravel below bricks supporting valve boxes to drain box. Set valve boxes over valve so all parts of valve can be reached for service. Set cover of valve box even with finish grade. Valve box cavity shall be reasonably free from dirt and debris.
  - 4. Wiring:
    - a. Use waterproof wire connectors consisting of properly-sized wire nut and grease cap at splices and locate all splices within valve boxes.
    - b. Traditional Wiring:
      - 1) Tape control wire to side of main line every **10 feet (3.050 m)**. Where control wire leaves main or lateral line, enclose it in gray conduit:
      - 2) Use white or gray color for common wire and other colors for all other wire. Each common wire may serve only one (1) controller.
      - 3) Run one (1) spare control wire from panel continuously from valve to valve throughout system similar to common wire for use as replacement if wire fails:
        - a) Run spare wire to each branch of system.
        - b) Spare wire shall be different color than other wires. Use of green wire is not acceptable.

- c) Mark spare control wire visibly within valve box as an 'Un-Connected Wire'. Extend spare control wires **24 inches (600 mm)** and leave coiled in each valve box. Mark spare wire visibly within controller as 'Un-Connected Wire'.

F. Hydrometer:

1. Install as detailed and as per manufacturer's recommendations.
2. If installed on secondary system, install downstream of filter.
3. Connect communication cables to smart controller. Run cables within conduit per specification.

G. Sprinkler Heads And Rotor Pop-ups:

1. Set sprinkler heads and quick-coupling valves perpendicular to finish grade.
2. Do not install sprinklers using side inlets. Install using base inlets only.
3. Heads immediately adjacent to mow strips, walks, or curbs shall be **one inch (25 mm)** below top of mow strip, walk, or curb and have **one inch (25 mm) to 3 inch (75 mm)** clearance between head and mow strip, walk, or curb.
4. Set sprinkler heads at consistent distance from walks, curbs, and other paved areas and to grade by using specified components or other method demonstrated in Pre-Construction Conference.

H. Drip Assembly:

1. Install pipe providing for expansion and contraction as recommended by Manufacturer.
2. Cut tubing square and remove burrs at cut ends.
3. Distribution tubing shall be between **14 inches (350 mm)** minimum and **48 inches (1 200 mm)** maximum long. Layout PVC lateral lines as necessary to keep distribution tubing lengths within specified tolerances.
4. Locate drip emitter on uphill side of plant within rootball zone.
5. Layout in-line tubing for trees as indicated on Contract Drawings. Layout in-line tubing for shrubs and groundcovers so plants receive water within rootball zones.
6. Locate in-line tubing on top of soil but under bark mulch and weed barrier fabric.
7. Staple in-line tubing to ground at **3 foot (900 mm) to 5 foot (1 500 mm)** maximum intervals (sand = **3 foot (900 mm)**, loam = **4 foot (1 200 mm)**, clay = **5 foot (1 500 mm)** and within **12 inches (300 mm)** of ends and intersections.
8. Assembly Using Solvent Weld Joints:
  - a. Do not make solvent weld joint if ambient temperature is below **35 deg F (2 deg C)**.
  - b. Clean mating pipe and fitting with clean, dry cloth.
  - c. Apply uniform coat of PVC solvent cement to outside of pipe and inside socket of fitting.
  - d. Insert pipe completely into fitting.
  - e. Give pipe or fitting quarter turn to insure even distribution of solvent and make sure pipe is inserted to full depth of fitting socket.
  - f. Allow joints to set twenty-four (24) hours minimum before applying pressure to pipe.
9. Assembly Using 'Funny Pipe' Type Joints:
  - a. Connect distribution tubing to lateral line using barbed ell fitting.
  - b. Connect fitting to distribution tubing using straight barbed fitting with **1/2 inch (13 mm)** threaded end.

- I. Arrange valve stations to operate in an easy-to-view progressive sequence around building. Tag valves with waterproof labels showing final sequence station assignments.

### 3.4 FIELD QUALITY CONTROL

A. Field Tests and Inspections:

1. Irrigation System:
  - a. System Pressure Test:
    - 1) Test pressure at **100 psi (690 kPA)** minimum for two (2) hours minimum.
    - 2) Verify there are no leaks.
    - 3) Receive Architect approval to proceed prior to backfilling.
2. Substantial Completion Walkthrough:
  - a. Architect or designated representative(s) will inspect site and create list of non-conforming items to be resolved prior to Landscape Final Acceptance. Date on this list will act as date of Landscape Substantial Completion.



- b. Installations completed after water source has been turned off for season, as determined by Landscape Architect, will be inspected following spring after system can be checked for proper operation.
  3. Irrigation Approval:
    - a. Irrigation will be approved when all non-conforming work is brought into conformance.
- B. Non-Conforming Work: Non-conforming work as covered in General Conditions applies, but is not limited to following:
1. Underground Sprinkler System:
    - a. Correct any work found defective or not complying with Contract Document requirements at no additional cost to Owner.

### 3.5 ADJUSTING

- A. Sprinkler Heads:
1. Adjust sprinkler heads to proper grade when turf is sufficiently established to allow walking on it without appreciable harm. Such lowering and raising of sprinkler heads shall be part of original contract with no additional cost to Owner.
  2. Adjust sprinkler heads for proper distribution and trim so spray does not fall on building.
- B. Watering Time:
1. Adjust watering time of valves to provide proper amounts of water to plants.

### 3.6 CLOSEOUT ACTIVITIES

- A. Training:
1. After system is installed and approved, instruct Owner's designated personnel in complete operation and maintenance procedures using Landscape Management Plan (LMP).
    - a. Describe difference between plant establishment schedule and long-term maintenance schedule.
    - b. Describe annual and regular filter maintenance.
- B. Winterization and Spring Start-Up:
1. During first year of operation, Installer shall shut-down irrigation system prior to freezing temperatures and re-start irrigation system at beginning of growing season:
    - a. Winter Shut-Down is intended to remove all potentially damaging water from irrigation system. Perform following as well as any other efforts necessary to properly winterize system:
      - 1) Turn off water source at point of connection.
      - 2) Blow out system with pressurized air, turning on each valve until water is cleared out of system. Run through system twice. Only blow out components suitable to receive pressurized air. Hydrometers, for instance, should not be blown out. Do not use excessive air pressure that will damage pipes and parts.
      - 3) Turn controller off.
      - 4) Open all manual drain valves.
      - 5) Drain, wrap, protect, or remove any backflow device exposed to freezing temperatures using manufacturer's recommendations and best practices. Coordinate method with Owner's Representative.
      - 6) Drain and remove pumps for Owner's Representative storage.
      - 7) Drain filters using manufacturer's recommendations.
      - 8) Check sprinkler heads to make sure they are below sidewalk and curb levels and not vulnerable to snowplow damage. Lower heads to proper elevation.
      - 9) Notify Owner's Representative when system has been turned off.
    - b. Spring start-up shall include following:
      - 1) Close all manual valves.
      - 2) Clean pump filters and replace if necessary.
      - 3) Remove freeze protection as required.
      - 4) Turn on water source at point of connection.

- 5) Verify that controller(s) and rain sensor are properly operating. Change battery in controller(s) and sensor(s) as required.
- 6) Flush entire system. Run each valve for two (2) minutes to check for damage, leaks, and coverage.
- 7) Repair and adjust system as needed. Fine tune heads for efficient coverage.
- 8) Notify Owner's Representative when system has been charged and is in full repair.

**END OF SECTION**



**SECTION 32 9001****COMMON PLANTING REQUIREMENTS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Common procedures and requirements for landscaping work.
- B. Related Requirements:
  - 1. Section 01 4301: 'Quality Assurance – Qualifications'.
  - 2. Section 31 0501: 'Common Earthwork Requirements'.
  - 3. Section 32 8423: 'Underground Sprinklers'.
  - 4. Section 32 9300: 'Plants'.

**1.2 REFERENCES**

- A. Definitions:
  - 1. Landscape Management Plan (LMP): LMP is an Owner's Representative's quick reference maintenance document. It is a combination of Irrigation Sections from 32 8000 and Planting Sections from 32 9000. The LMP document is created from Operations and Maintenance Data, Warranty Documentation, and Record Documentation
  - 2. Landscape Final Acceptance: Inspection, no less than (30) days following substantial completion, when all work has been completed, demonstrated, and approved by the Landscape Architect. Coordinate with Sections 32 8423 and Sections under 32 9000 'Planting'.
  - 3. Plant Establishment Period: Time required for plants to successfully develop root systems into surrounding soil. Following this period, irrigation run times are typically modified. For purposes of this contract, the plant establishment period is assumed to be one (1) year from date of Substantial Completion.

**1.3 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-Installation Conference:
  - 1. In addition to agenda items specified in Section 01 3100, review the following:
    - a. Site Visits:
      - 1) If site conditions necessitate additional visits, Landscape Architect can schedule addition site visits with approval from Architect prior to bid.
      - 2) During construction, addition site visits may be approved in writing by Architect or Owner for special considerations before commencement.
      - 3) Site visits caused by lack of work progress by Landscape Subcontractor shall reimburse Landscape Architect amount determined by Architect or Owner for additional site visits.
    - b. Coordination:
      - 1) Landscape Subcontractor and Landscape Architect to coordinate site visits and include Architect and General Contractor in communications.
    - c. Landscape Maintenance:
      - 1) Establish responsibility for maintenance of new landscaping during all phases of construction period.
    - d. Percolation Test:
      - 1) Prepare two (2) typical landscape planting excavations and conduct percolation test to verify that water drains away within two (2) hours.
      - 2) Discuss results of percolation tests with Architect and Owner's Representative.
    - e. Review additional agenda items as specified in related sections listed above.
  - 2. Approved Site Visits:

- a. Site Visit No. 1:
  - 1) Description:
    - a) Inspect and approve plant quality, plant quantity, plant pits, plant pit backfill, planting depths, and removal of packaging/distribution materials, wire, and ties.
  - 2) Schedule: Conduct site visit one (1) week minimum after notification from Contractor before beginning site visit no. 1.
  - 3) Required Attendees:
    - a) General Contractor, Landscape Subcontractor, Landscape Architect.
  - 4) Recommended Attendees:
    - a) Project Manager, Facilities Manager.
  - 5) Related Sections:
    - a) Section 32 9300: 'Plants'.
  - 6) Notes:
    - a) Inspect irrigation system installation, inspect weed barrier fabric.
- b. Site Visit No. 2:
  - 1) Description:
    - a) Comprehensive Substantial Completion inspection prior to beginning thirty (30) day Landscape Subcontractor maintenance period.
  - 2) Schedule: Conduct site visit one (1) week minimum after notification before beginning site visit no. 2.
  - 3) Required Attendees:
    - a) Project Manager, Facilities Manager, Architect, General Contractor, Landscape Subcontractor, Landscape Architect.
  - 4) Related Sections:
    - a) Section 32 8423: 'Underground Sprinklers'.
    - b) Section 32 9300: 'Plants'.
  - 5) Notes:
    - a) Verify contract requirements have been followed including but not limited to: planting compliance, irrigation system coverage and irrigation system operation.
- c. Site Visit No. 3:
  - 1) Description:
    - a) At the end of thirty (30) day Landscape Subcontractor maintenance period, verify deficient items have been corrected and verify no others exist.
  - 2) Schedule: Conduct site visit one (1) week minimum after notification before beginning site visit no. 3.
  - 3) Required Attendees:
    - a) Project Manager, Facilities Manager, Architect, General Contractor, Excavation Subcontractor, Landscape Subcontractor, Landscape Architect.
  - 4) Related Sections:
    - a) Section 32 8423: 'Underground Sprinklers'.
    - b) Section 32 9300: 'Plants'.
  - 5) Notes:
    - a) Review Landscape Management Plan (LMP) with Owner's Representative. Provide landscape maintenance training.

## 1.4 SUBMITTALS

- A. Informational Submittals:
  1. Certificates:
    - a. Landscape Architect will provide certificate acknowledging 'Plant Establishment Period' commencement:
      - 1) Certificate will include name and signature of Contractor, Contractor's company, Contractor's telephone number, and date.
      - 2) Certificate will include name and signature of Owner's Representative, Owner's Representative's Group name, Owner's Representative Group telephone number, and date.
      - 3) Certificate will acknowledge date when Establishment Period begins and that it extends one (1) year from that time.
  2. Special Procedure Submittals:

- a. Installer to provide two (2) copies of following recommendations to be included in Closeout Submittals:
  - 1) Landscape maintenance recommendations.
  - 2) Individual landscape maintenance recommendations.
  - 3) Plant establishment maintenance recommendations.
  - 4) Post-plant establishment maintenance recommendations.
- 3. Qualification Statement:
  - a. Landscape Subcontractor:
    - 1) Provide Qualification documentation if requested by Landscape Architect or Owner.
  - b. Installer:
    - 1) Provide Qualification documentation if requested by Landscape Architect or Owner.
- B. Closeout Submittals:
  - 1. Include following in Operations And Maintenance Manual specified in Section 01 7800 (combine with sections of 32 8000 and sections of 32 9000 if applicable):
    - a. Record Documentation:
      - 1) Submit one (1) copy certificate for 'Plant Establishment Period' acknowledgement.
      - 2) Submit one (1) copy of recommendations specified in Special Procedure Submittals.
      - 3) Record Drawings:
        - a) As installation occurs, prepare accurate record drawings. Submit one (1) full size copy prior to final inspection. Drawing shall include:
          - (1) Detail and dimension changes made during construction.
          - (2) Take dimensions from permanent constructed surfaces or edges located at or above finish grade.
    - b. Landscape Management Plan (LMP):
      - 1) Landscape Section:
        - a) Submit one (1) copy certificate for 'Plant Establishment Period' acknowledgement.

## 1.5 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Landscape Subcontractor. Requirements of Section 01 4301 applies, but not limited to following:
    - a. Company specializing in performing work of this section.
    - b. Minimum five (5) years' experience in landscaping installations.
    - c. Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
    - d. Upon request, submit documentation.
  - 2. Installer:
    - a. Planting shall be performed under direction of foreman or supervisor with minimum three (3) years' experience in landscape installations similar in size, scope, and complexity.
    - b. Foreman or supervisor required to attend pre-installation conference.
    - c. Use trained personnel familiar with required planting procedures and with Contract Documents.
    - d. Upon request, submit documentation.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Storage And Handling Requirements:
  - 1. Deliver packaged materials in containers showing weight, analysis, and name of Manufacturer.
  - 2. Deliver sod, plants, trees, and shrubs in healthy and vigorous condition.
  - 3. Protect materials from deterioration during delivery.
- B. Storage And Handling Requirements:
  - 1. Store in location on site where they will not be endangered and where they can be adequately watered and kept in healthy and vigorous condition.
  - 2. Protect materials from deterioration while stored at site.

## **PART 2 - PRODUCTS**

### **2.1 POST-EMERGENT WEED CONTROL**

- A. Type Two Acceptable Products:
  - 1. Enide by Upjohn.
  - 2. Dymid by Elanco.
  - 3. Treflan or Surflan by Dow Agrosiences.
  - 4. Eptan by Syngenta.
  - 5. Equal as approved by Architect before use. See Section 01 6200.

## **PART 3 - EXECUTION**

### **3.1 INSTALLERS**

- A. Acceptable Installers:
  - 1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

### **3.2 EXAMINATION**

- A. Verification Of Conditions:
  - 1. Inspect site and Contract Documents to become thoroughly acquainted with locations of irrigation, ground lighting, and utilities.

### **3.3 PREPARATION**

- A. Before proceeding with work, verify dimensions and quantities. Report variations between Drawings and site to Architect before proceeding with landscape work.
  - 1. Plant totals are for convenience of Contractor only and are not guaranteed. Verify amounts shown on Drawings.
  - 2. All planting indicated on Contract Documents is required unless indicated otherwise.
- B. Protection:
  - 1. Take care in performing landscaping work to avoid conditions that will create hazards. Post signs or barriers as required.
  - 2. Provide adequate means for protection from damage through excessive erosion, flooding, heavy rains, etc. Repair or replace damaged areas.
  - 3. Keep site well drained and landscape excavations dry.

### **3.4 INSTALLATION**

- A. Interface With Other Work:
  - 1. Do not plant trees and shrubs until major construction operations are completed. Do not commence landscaping work until work of Section 31 2216 and Section 32 8423 has been completed and approved.
- B. Coordinate installation of planting materials during normal planting seasons for each type of plant material required.
- C. Hand excavate as required.
- D. Maintain grade stakes until parties concerned mutually agree upon removal.

- E. When conditions detrimental to plant growth are encountered, such as rubble fill or adverse drainage conditions, notify Architect before planting.

### 3.5 FIELD QUALITY CONTROL

- A. Field Inspection:
  - 1. Landscape Architect will inspect landscaping installation for Substantial Completion.
- B. Non-Conforming Work. Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
  - 1. Replace damaged plantings within (10) days of notification at no additional cost to Owner.
  - 2. Repair damage to irrigation, ground lighting, utilities, paving, concrete curb and gutters and other items adjacent to landscaping caused by work of this Section or replace at no additional cost to Owner.

### 3.6 CLEANING

- A. Waste Management:
  - 1. Immediately clean up soil or debris spilled onto pavement and dispose of deleterious materials.

### 3.7 CLOSEOUT ACTIVITIES

- A. Instruction Of Owner:
  - 1. Include following training:
    - a. Review Landscape Management Plan (LMP):
      - 1) Review maintenance recommendations.
    - b. Review Maintenance as specified at the end of this specification.
  - 2. Establishment Period Acknowledgement (coordinate with 32 8000 section):
    - a. Landscape Architect will acknowledge Establishment Period commencement.

### 3.8 PROTECTION

- A. Protect planted areas against traffic or other use immediately after planting is completed by placing adequate warning signs and barricades.
- B. Provide adequate protection of planted areas against trespassing, erosion, and damage of any kind. Remove this protection after Architect has accepted planted areas.

### 3.9 MAINTENANCE

- A. General:
  - 1. Before beginning maintenance period, plants shall be in at least as sound, healthy, vigorous, and in approved condition as when delivered to site, unless accepted by Architect in writing at final landscape inspection.
  - 2. Maintain landscaping for thirty (30) continuous days minimum after Substantial Completion. If maintenance period is interrupted by non-growing season or irrigation winter shut-down, begin maintenance period after start of growing season as agreed with Architect, and continue one (1) continuous month therefrom.
  - 3. Replace landscaping that is dead or appears unhealthy or non-vigorous as directed by Architect before end of maintenance period. Make replacements within ten (10) days of notification. Lawn being replaced shall be guaranteed and maintained an additional thirty (30) days from date of replacement.
- B. Trees, Shrubs, And Plants:
  - 1. Maintain by pruning, cultivating, and weeding as required for healthy growth.



2. Restore planting basins.
3. Tighten and repair stake and guy supports and reset trees and shrubs to proper grades or vertical positions as required.
4. Spray as required to keep trees and shrubs free of insects and disease.
5. Provide supplemental water by hand as needed in addition to water from sprinkling system.

**END OF SECTION**

**SECTION 32 9300****PLANTS****PART 1 - GENERAL****1.1 SUMMARY**

- A. Includes But Not Limited To:
  - 1. Furnish and install landscaping plants as described in Contract Documents.
- B. Related Requirements:
  - 1. Section 32 8423: 'Underground Sprinklers' for irrigation system.
  - 2. Section 32 9001: 'Common Planting Requirements' for:

**1.2 REFERENCES**

- A. Definitions:
  - 1. Crop Coefficients and Hydro-Zones: Crop coefficients (Kc) are used with ETo to estimate specific plant evapotranspiration rates. Crop coefficient is dimensionless number (between 0 and 1.2) that is multiplied by ETo value to arrive at plant ET (ETc) estimate. Plants grouped by water needs, organized into one irrigation zone.
  - 2. Eco-Region Irrigation Design: Bio-regional approach to irrigation and planting design that is relevant to geographic area for which planting plan and irrigation system is designed. These geographic areas are defined by Environmental Protection Agency and have been modified by the Church into 15 geographical areas throughout North America, and Hawaiian Islands.
  - 3. Hardiness Zone: Hardiness zone is more precisely geographically-defined zone within an Eco-Region in which specific category of plant life is capable of growing, as defined by temperature hardiness, or ability to withstand minimum temperatures of zone. Hardiness Zones may be defined by one of two sources:
    - a. Sunset Western Garden Book Maps.
    - b. USDA Hardiness Zone Map.Plant Hardiness zone sources shall be listed by Landscape Architect through planting and irrigation design process.
  - 4. Hydro-Zone: Plants grouped by water needs (similar Crop Coefficients (Kc), organized into one irrigation zone.
  - 5. Landscape Management Plan (LMP): See Section 32 9001 for definition.
  - 6. Plant Establishment Period: See Section 32 9001 for definition.
  - 7. Reference Evapotranspiration (ETo): Total water lost from the soil (evaporation) and from plant surface (transpiration) over some period.
- B. Reference Standards:
  - 1. American Nursery & Landscape Association / American National Standards Institute:
    - a. ANLA / ANSI Z60.1-2004, 'American Standard for Nursery Stock'.
  - 2. American National Standard Institute / Tree Care Industry Association (TCIA):
    - a. ANSI A300 (Part 1)-2017 Pruning, 'American National Standard for Tree Care Operations – Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Pruning)'.

**1.3 SUBMITTALS**

- A. Action Submittals:
  - 1. Samples:
    - a. Top dressing mulch for approval before delivery to site.

- B. Closeout Submittals:
  - 1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    - a. Operations And Maintenance Data:
      - 1) Submit one (1) copy of recommendations specified in Special Procedure Submittals.
    - b. Warranty Documentation:
      - 1) Include written warranty.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Delivery And Acceptance Requirements:
  - 1. Deliver trees, shrubs, ground covers, and plants after preparations for planting have been completed and install immediately.
  - 2. Do not prune before delivery, except as approved by Landscape Architect.
  - 3. Protect bark, branches, and root systems from sun scald, drying, whipping, and other handling and tying damage.
  - 4. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape.
  - 5. Provide protective covering during delivery.
- B. Storage And Handling Requirements;
  - 1. Handle balled stock by root ball or container. Do not drop trees and shrubs during delivery.
  - 2. If planting is delayed more than six hours after delivery, set planting materials in shade and protect from weather and mechanical damage.
  - 3. Set balled stock on ground and cover ball with soil, saw dust, or other acceptable material approved by Landscape Architect.
  - 4. Do not remove container-grown stock from containers before time of planting.
  - 5. Do not store plant material on pavement.
  - 6. Water root systems of trees and shrubs stored on site with fine spray. Water as often as necessary to maintain root systems in moist condition. Do not allow plant foliage to dry out.

#### 1.5 WARRANTY

- A. Special Warranty:
  - 1. Provide written warranties as follows:
    - a. Warranty will extend thirty (30) continuous days minimum after Substantial Completion. If a continuous first thirty (30) days of the warranty period is interrupted by non-growing season or irrigation winter shut-down, begin warranty period after start of growing season as agreed on with Architect. Thereafter, continue warranty per the period described herein.
    - b. Warranty shrubs, ground covers, and vines to live and remain in strong, vigorous, and healthy condition for 90 days minimum from date of Substantial Completion and meet or exceed material standards set forth in Materials heading of Part 2 of this specification.
    - c. Warranty trees to live and remain in strong, vigorous, and healthy condition and meet or exceed material standards set forth in Materials heading of Part 2 of this specification for one year from date of Substantial Completion.
    - d. When trees are completely accepted at end of warranty period, remove staking.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Plants:
  - 1. Replant modified areas with similar plants removed and to ANLA / ANSI Z60.1.
  - 2. Quality:
    - a. Plants shall be sound, healthy, vigorous, free from plant disease, insect pests or their eggs, noxious weeds, and have healthy, normal root systems. Container stock shall be well established and free of excessive root-bound conditions.

- b. Do not prune plants or top trees prior to delivery.
  - c. Plant materials shall be subject to approval by Landscape Architect as to size, health, quality, and character.
  - d. Bare root trees are not acceptable.
  - e. Provide plant materials from licensed nursery or grower.
3. Measurements:
- a. Measurement should be average of plant, not greatest diameter. For example, plant measuring **15 inches (375 mm)** in widest direction and **9 inches (225 mm)** in narrowest would be classified as **12 inch (300 mm)** stock.
  - b. Plants properly trimmed and transplanted should measure same in every direction.
  - c. Measure caliper of trees **6 inches (150 mm)** above surface of ground.
  - d. Where caliper or other dimensions of plant materials are omitted from Plant List, plant materials shall be normal stock for type listed.
  - e. Plant materials larger than those specified may be supplied, with prior written approval of Landscape Architect, and:
    - 1) If complying with Contract Document requirements in all other respects.
    - 2) If at no additional cost to Owner.
    - 3) If sizes of roots or balls are increased proportionately.
4. Shape and Form:
- a. Plant materials shall be symmetrical or typical for variety and species and conform to measurements specified in Plant List.
  - b. Well grown material will generally have height equal to or greater than spread. However, spread shall not be less than  $2/3$ 's of height.

## 2.2 ACCESSORIES

- A. Planting Mix:
1. Mixture of three (3) parts excavated soil and one part well rotted composted manure, approved commercial mix, or other amendment recommended in 'Topsoil Testing Report'.
- B. Tree Stakes:
1. Type Two Acceptable Products:
    - a. **2 inch (50 mm)** diameter Lodgepole Pine, Douglas Fir, White Fir, or Hemlock Fir.
    - b. Equal as approved by Landscape Architect before installation. See Section 01 6200.
- C. Tree Staking Ties:
1. Type Two Acceptable Products:
    - a. **32 inch (800 mm)** Cinch-Tie tree ties by V.I.T. Products Inc, Escondido, CA [www.vitproducts.com](http://www.vitproducts.com).
    - b. Equal as approved by Landscape Architect before installation. See Section 01 6200.
- D. Tree Guys:
1. Type Two Acceptable Products:
    - a. Duckbill Model 68DTS guying kit.
    - b. Equal as approved by Landscape Architect before installation. See Section 01 6200.
- E. Pre-Emergent Herbicide:
1. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
    - a. Chipco Dimension Granular by The Andersons Inc, Maumee, IL [www.andersonsinc.com](http://www.andersonsinc.com).
    - b. Elanco XL2G granular by Crop Data Management Systems, Marysville, CA [www.cdms.net](http://www.cdms.net).
    - c. Ronstar G granular by Bayer Crop Science, Monheim, Germany [www.bayercropscience.com](http://www.bayercropscience.com).
    - d. Surflan AS liquid by United Phosphorous Inc, Trenton, NJ [www.upi-usa.com](http://www.upi-usa.com).
    - e. Oryzalin 4 A.S. liquid by FarmSaver, Seattle, WA [www.farmsaver.com](http://www.farmsaver.com).
- F. Weed Barrier:
1. Type Two Acceptable Products:
    - a. DeWitt **4.1 oz (116 g)** 20 year woven polypropylene weed barrier.

- b. Hanes Pro-Platinum 4.1 oz (116 g) 20 year woven polypropylene weed barrier.
  - c. Equal as approved by Landscape Architect before bidding. See Section 01 6200.
- G. Bark Or Wood Top Dressing Mulch:
1. Type Two Acceptable Products:
    - a. Medium size Fir bark.
    - b. Medium or large size Redwood bark.
    - c. Shredded pine bark.
    - d. Shredded Cedar.
    - e. Equal as approved by Landscape Architect before installation. See Section 01 6200.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Evaluation And Assessment:
1. Before proceeding with work, check and verify dimensions and quantities. Report variations between Drawings and site to Landscape Architect before proceeding with work of this Section.
  2. Plant totals are for convenience only and are not guaranteed. Verify amounts shown on Contract Documents. All planting indicated on Contract Documents is required unless indicated otherwise.
  3. Do not commence with this Work until grading tolerances specified in Section 32 9122 'Topsoil Grading' are met.

### **3.2 PREPARATION**

- A. Plant Approval:
1. Compliance:
    - a. Prior to any plant installation, evaluate plants for compliance with material standards.
    - b. Remove plants from site that do not comply.
  2. Inspection:
    - a. Prior to any tree installation, inspect one (1) extra deciduous tree and one (1) extra evergreen tree for root health.
    - b. In presence of Landscape Architect or by video recording, remove root container/packing material and inspect root balls for soil depth, firmness and root structure by washing soil off of roots.
    - c. If delivered plants exhibit soil 1 inch (25 mm) or more above root collar, demonstrate that all trees have had excess soil removed prior to planting or that they meet standard.
    - d. Remove and replace tree plant material if roots are loose, significantly circling, significantly asymmetrical or damaged.
    - e. Continue inspection process until trees meet standard.
- B. Layout individual tree and shrub locations and areas for multiple plantings:
1. Stake locations and outline areas.
  2. Secure Landscape Architect's approval before planting.
  3. Make minor adjustments as may be requested.

### **3.3 INSTALLATION**

- A. Interface With Other Work:
1. Do not commence work of this Section until work of Section 32 9122 has been completed and approved.
- B. Excavation:
1. If underground construction work or obstructions are encountered in excavation of planting holes, Landscape Architect will select alternate locations.

2. Plant Excavation Size:
    - a. Diameter: Twice diameter of root ball or container minimum.
    - b. Depth: Equal to container or rootball depth.
  3. Unless excavated material meets topsoil requirements as specified in Section 32 9113, remove from landscape areas and do not use for landscaping purposes.
  4. Roughen sides and bottoms of excavations.
  5. With approval of Landscape Architect, select five (5) typical planting excavations throughout site for drainage testing.
    - a. Fill selected excavations with water and verify that water drains away at rate of **3 inches (75 mm)** per hour minimum. Inform Landscape Architect in writing of excavations where water does not drain properly.
    - b. Select three (3) excavations approximately **5 feet (1 500 mm)** away from each non-draining excavation and repeat tests. Continue testing process until non-draining areas have been identified.
    - c. In excavations located in identified non-draining areas, auger **6 inch (150 mm)** diameter hole **4 feet (1 200 mm)** deep in low point of each excavation and fill with tamped planting mix.
    - d. Do not plant trees or shrubs in holes that do not properly drain.
- C. Planting:
1. Removing Binders And Containers:
    - a. Remove top one / third of wire basket and burlap binders.
    - b. Remove plastic and twine binders from around root ball and tree trunk.
    - c. Remove plastic containers.
    - d. Remove wood boxes from around root ball. Remove box bottoms before positioning plant in hole. After plant is partially planted, remove remainder of box without injuring root ball.
  2. Plant immediately after removing binding material and containers:
    - a. Place tree and shrub root balls on undisturbed soil.
    - b. After watering and settling, top of tree root balls shall be approximately **two inches (50 mm)** higher than finished grade and trunk flare is visible.
    - c. Shrub root balls shall be approximately **one inch (25 mm)** higher than finished grade.
  3. Properly cut off broken or frayed roots.
  4. Center plant in hole, remove remaining wire basket and burlap taking care not do damage root ball:
    - a. Replace damaged material.
    - b. Backfill with specified planting mix.
    - c. Except in heavy clay soils, make ring of mounded soil around hole perimeter to form watering basin.
  5. Fill landscape excavations with tamped planting mix and recommended fertilizer:
    - a. Compact in **6 inch (150 mm)** lifts.
    - b. Settle by watering to ensure top of root ball is **2 inches (50 mm)** higher for trees and **one inch (25 mm)** higher for shrubs than surrounding soil following compaction and settling.
  6. Do not use muddy soil for backfilling.
  7. Make adjustments in positions of plants as directed by Landscape Architect.
  8. Thoroughly water trees and shrubs immediately after planting.
  9. At base of each tree, leave **36 inch (900 mm)** diameter circle free of any grass.
- D. Tree and Shrub Pruning:
1. Prune trees and shrubs to remove dead, broken, and split branches in conformance with ANSI A300 (Part 1) Pruning.
- E. Supports for New Trees:
1. Provide new supports for trees noted on Contract Documents to be staked.
    - a. Remove nursery stakes delivered with and attached to trees.
    - b. Support shall consist of at least two (2) tree stakes driven into hole base before backfill so roots are not damaged. Place stakes vertically and run parallel to tree trunk. Install stakes so **3 feet (900 mm)** of stake length is below finish grade.
    - c. Deciduous Trees:
      - 1) Place tree ties **6 to 12 inches (150 to 300 mm)** below crotch of main tree canopy. Second set of tree ties may be required **18 to 24 inches (450 to 600 mm)** above finish grade, if directed by Landscape Architect.

- 2) Remove tops of tree stakes so top of stake is **6 inches (150 mm)** below main tree canopy to prevent damage to tree branches and canopy growth.
  - d. Evergreen Trees:
    - 1) Place tree ties 2/3's of height of tree up from root ball.
  2. Provide root guying kits to support **24 inch (600 mm)** box, **3 inch (75 mm)** caliper and larger trees.
  3. Staking and guying should allow some tree movement.
- F. Vines:
1. Remove from stakes, untie, and securely fasten to wall or fence next to which they are planted.
- G. Ground Covers:
1. Container-grown unless otherwise specified on Contract Documents. Space evenly to produce a uniform effect, staggered in rows and intervals shown.
- H. Post Planting Weed Control:
1. Apply specified pre-emergent herbicide to shrub and ground cover planting areas and grass-free areas at tree bases after completion of planting.
  2. Areas shall be weed free prior to Landscape Final Acceptance.
- I. Weed Barrier Fabric:
1. After planting and application of herbicide in shrub beds, apply covering of specified weed barrier fabric.
  2. Achieve 100 percent coverage over ground areas while allowing space for growth from root ball.
  3. Overlap seams **6 inches (150 mm)** minimum.
  4. Staple at **5 feet (1500 mm)** on center each way and within **3 inches (75 mm)** of edge of shrub bed, with two (2) at each corner.
- J. Mulching:
1. After application of herbicide, mulch shrub and ground cover planting areas with **3 inches (75 mm)** deep layer of specified top dressing or rock mulch.
  2. Cover grass-free area at tree bases with **3 inches (75 mm)** of top dressing mulch or rock mulch.
  3. Place mulch to uniform depth and rake to neat finished appearance.

**END OF SECTION**