

# PROJECT MANUAL

## RENOVATE CHAPMAN HALL ENROLLMENT CENTER VIRGINIA WESTERN COMMUNITY COLLEGE MAIN CAMPUS

3094 COLONIAL AVE SW | ROANOKE VA 24015

VIRGINIA COMMUNITY COLLEGE SYSTEM

STATE PROJECT NUMBER:  
**260-B5260-019**

SPECTRUM PROJECT NUMBER:  
**24065**

PROJECT PHASE:  
**BID DOCUMENTS**

DATE:  
**11.14.2025**



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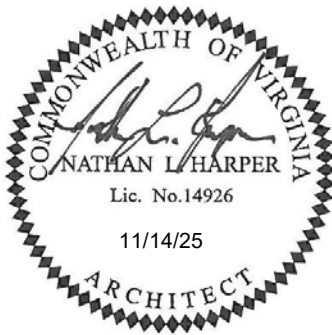
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**NOTICE OF INVITATION FOR BIDS (IFB)  
VIRGINIA COMMUNITY COLLEGE SYSTEM  
VIRGINIA WESTERN COMMUNITY COLLEGE  
RENOVATE CHAPMAN HALL ENROLLMENT CENTER  
PROJECT CODE # 260-B5260-019 (L24VW573)**

Sealed bids are invited for the construction of the renovate Chapman Hall Enrollment Center project at Virginia Western Community College, Project Code # 260-B5260-019 (L24VW573) located in Roanoke, Virginia. The project is generally described as an interior renovation to the Chapman Hall. The 1961 structure contains 9,650 gross square feet. Departments served include Enrollment, Records, Financial Aid, Career Counseling, and Advising. The building was last renovated in 2005; since then, however, the departments, practices, procedures, personnel needs, technology, and space requirements have changed significantly. The current spaces are no longer functional for their uses, and the interior renovation will update the building to make the space more user-friendly, functional, and accessible.

Sealed bids will be received electronically through eVA or at **Virginia Community College System, Attention: Mrs. Sibyl Roberts, 300 Arboretum Place, Suite 200, Richmond, Virginia 23236, Telephone (804) 819-4918.** **PLEASE NOTE:** For shipping/mailling, use Suite 390; for hand delivery, use Suite 200. **The deadline for submitting bids is 2:00 P.M. sharp, as determined by the Bid Officer, on Tuesday, January 13, 2026.** The bids will be opened publicly and read aloud **beginning** at 2:00 P.M., on the following day, **Wednesday, January 14, 2026**, at the same location.

**In person hand delivery is supported on bid day at the stated location. Building is open during regular business hours. All visitors need to sign in at the virtual receptionist (iPad on the wall in the main lobby.) Bids may be modified as per the Instructions to Bidders using fax number (804) 819-4762 and copying [sroberts@vccs.edu](mailto:sroberts@vccs.edu).**

A Standard Commonwealth Bid Bond is required (form CO-10.2) and Contract Security is required for any bid regardless of the bid amount.

**eVA Vendor Registration:** The bidder or offeror shall be a registered vendor in eVA. See the attached **eVA Vendor Registration Requirements**.

Procedures for submitting a bid, claiming an error, withdrawal of bids and other pertinent information are contained in the Instructions to Bidders, which is part of the Invitation for Bids. Withdrawal due to error in bid shall be permitted in accord with Section 9 of the Instructions to Bidders and § 2.2-4330, Code of Virginia. The Owner reserves the right to reject any or all bids.

A **pre-bid conference** will be held at **2:00 P.M. on Thursday, December 11, 2025**, at Virginia Western Community College, 3094 Colonial Avenue, SW, Roanoke, Virginia 24015 in meeting room N101 of the Natural Science Center. Attendance is **optional** but highly recommended for those submitting a bid as the best way to see the facility since VWCC will effectively be closed for the holidays from 12/20/2025 through 01/04/2026 and individual site visits will be difficult to schedule after then through the bid receipt date.

The contract shall be awarded on a lump sum basis as follows: the Total Base Bid Amount including any properly submitted and received bid modifications plus such successive Additive Bid Items as the Owner in its discretion decides to award in the manner set forth in Paragraph 12 of the Instructions to Bidders. 'Notice of Award' will be posted on eVA, Virginia Department of General Services' central electronic procurement website, at <https://eva.virginia.gov>.

Contractor registration is required in accordance with Section 54.1-1103 of the Code of Virginia. See the Invitation for Bids for additional qualification requirements.

All executive branch agencies are directed to advance Executive Order 35, dated July 3, 2019.

The Invitation for Bids for the above project, including the drawings and the specifications containing the information necessary for bidding, are available for download from the eVA website at [www.eva.virginia.gov](http://www.eva.virginia.gov).

Authorized Official of Owner/Agency  
Commonwealth of Virginia  
State Board for Community Colleges

Attachment: eVA Vendor Registration Requirements

## **Vendor eVA Registration Requirements**

**eVA Business-to-Government Vendor Registration, Contracts, and Order:** The eVA Internet electronic procurement solution, web site portal [www.eVA.virginia.gov](http://www.eVA.virginia.gov), streamlines and automates government purchasing activities in the Commonwealth. The eVA portal is the gateway for vendors to conduct business with state agencies and public bodies. All vendors desiring to provide construction and/or professional services to the Commonwealth shall participate in the eVA Internet e-procurement solution by completing the free eVA Vendor Registration. All bidders or offerors must register in eVA and pay the Vendor Transaction Fees specified below; failure to register will result in their bid/proposal being rejected.

Vendor transaction fees are determined by the date the original purchase order is issued and the current fees can be found on the eVA website at <https://eva.virginia.gov/eva-billing.html>.

**eVA Orders and Contracts:** The solicitation/contract will result in one (1) purchase order(s) with the eVA applicable transaction fee assessed for each order.

### **INSTRUCTIONS TO BIDDERS**

**The Invitation For Bids (“IFB”)** consists of the Notice, these Instructions To Bidders, the Bid Form, the Pre-Bid Question Form, the General Conditions of the Construction Contract, the Supplemental General Conditions (if any), the Special Conditions (if any), the Forms to be used, and the Scope of Work as described by the Plans and Specifications, other documents listed in the Specifications, and any addenda which may be issued, all of which request qualified bidders to submit competitive prices or bids for providing the described work of the Contract.

As used herein, the terms “bidder” and “Contractor” both shall refer to the Person submitting a bid.

**eVA Vendor Registration:** The bidder shall be a registered vendor in eVA. See the attached **eVA Vendor Registration Requirements**.

1. **CONDITIONS AT SITE OR STRUCTURE:** Bidders shall visit the Site and shall be responsible for ascertaining pertinent local conditions such as location, accessibility, general character of the Site, structure or building, and the character and extent of existing conditions, improvements or work within or adjacent to the Site. No Claims shall be submitted as a result of Bidder’s failure to have done so, but shall be deemed waived and will not be considered by the Owner. See Section 7 of the General Conditions entitled "Conditions at Site."
2. **EXPLANATIONS TO BIDDERS:** No oral explanation in regard to the meaning of drawings and specifications will be made and no oral instructions will be given before the award of the Contract. The Owner shall not be responsible for any conclusions, assumptions or interpretations made by bidders during the preparation of bids that are contrary to the Drawings and Specifications and their clear intent. Discrepancies, conflicts, errors, omissions or doubts as to the meaning of the Contract Documents shall be communicated in writing to the A/E for interpretation. Bidders **must** use the "Prebid Question Form" provided in the bid documents. Bidders must so act to assure that questions reach the A/E at least six (6) days prior to the time set for the receipt of bids to allow a sufficient time for an addendum to reach **all bidders** before the submission of their bids. If, however, there are two (2) weeks or less between the first bid advertisement and the time set for receipt of bids, then bidders must submit questions so that they reach the A/E no later than three (3) days prior to the time set for receipt of bids. Any interpretation made will be in the form of an addendum to the Specifications which will be forwarded to all bidders, and its receipt shall be acknowledged by the bidder on Bid Forms. If such discrepancies, conflicts, errors, omissions or doubts are reasonably apparent or should have been reasonably apparent to the bidder, and the bidder failed to submit questions to the A/E in the time and manner required herein and the Contract is awarded to the bidder, then any claims shall be deemed waived and the bidder shall not be entitled to additional compensation or time, or entitled to sue the Owner based on such discrepancies, conflicts, errors, omissions, or doubts.
3. **TIME FOR COMPLETION:**
  - (a) "Time for Completion" shall be designated by the Owner on the Invitation for Bids or other prebid documents and shall mean the number of consecutive calendar days following the issuance of the Notice to Proceed which the Contractor has to substantially complete all Work required by the Contract. In some instances, the Time for Completion may be stated in the form of a Contract Completion Date based on a stipulated date of Notice to Proceed.

Unless otherwise specified, the Contractor shall achieve Final Completion within thirty (30) days after the date of Substantial Completion.
  - (b) When the Notice to Proceed is issued, it will state a Contract Completion Date, which has been set by the Owner based on date of the Notice to Proceed and the Time for Completion.

- (c) The Contractor, in preparing and submitting its bid, is required to take into consideration normal weather conditions. Normal weather does not mean statistically average weather, but rather means a range of weather patterns which might be anticipated based on weather conditions and events for the past ten (10) years. Normal weather conditions shall be determined from the public historical records available, including the U.S. Department of Commerce, Local Climatological Data Sheets, Oceanic and Atmospheric Administration/Environmental Data and Information Service, National Climatic Center and the National Weather Service. The data sheets to be used shall be for the locality or localities closest to the Site. No additional compensation, costs or damages will be paid to the Contractor because of normal weather conditions, including normal adverse weather to be anticipated during the Project. An extension of time for abnormal adverse weather conditions which directly impact the Work will be considered by the Owner as set forth in the General Conditions.
- (d) If the Owner designates the public historical climatological records to be used to establish normal weather patterns, the bidder shall use those records in estimating and preparing its bid. If the Owner requests each bidder to indicate the weather pattern records used in preparation of a bid, each bidder may select the public historical climatological records upon which it will rely in preparing its bid. In the latter situation, each bidder shall designate in the space provided which of such climatological data records were used in preparing the bid. A bidder's failure to designate climatological records when submitting a bid shall not disqualify a bid, but shall constitute a waiver of any claim or request for an extension of time as the result of abnormal adverse weather. In either case, the bid submitted and the Time for Completion shall be presumed to have been based upon normal weather patterns, including normal adverse weather, as derived from the climatological records used.

#### **4. PREPARATION AND SUBMISSION OF BIDS:**

- (a) Bids shall be submitted on the forms furnished, or copies thereof, and shall be signed in ink, or in the case of bids submitted electronically, signatures shall be in accordance with Code of Virginia § 59.1-479 *et seq.* The Owner's agreement to accept electronic bids, if made, will be indicated in the IFB. Erasures or other changes in a bid must be explained or noted over the signature of the bidder. Bids containing any conditions, omissions, unexplained erasures, alterations or items not called for in the proposal, or irregularities of any kind, may be rejected by the Owner as being incomplete or nonresponsive.
- (b) Each bid must give the complete legal name and full business address of the bidder and be signed by the bidder, or the bidder's authorized representative. Bids by partnerships must be signed in the partnership name by one of the general partners of the partnership or an authorized representative, followed by the designation/title of the person signing, and a list of the partners. Bids by joint ventures must be signed in the joint venture name by one of the joint venturers or an authorized representative of one of the joint venturers, followed by the designation/title of the person signing, and a list of the joint venturers. Bids by corporations must be signed with the legal name of the corporation followed by the name of the state in which it is incorporated and by the signature and title of the person authorized to bind it in this matter. The name of each person signing shall be typed or printed below the signature. A signature on a bid by a person who identifies their title as "President," "Secretary," "Agent" or other designation without disclosing the principal firm, shall be held to be the bid of the individual signing. When requested by the Owner, satisfactory evidence of the authority of the officer signing on behalf of the corporation shall be furnished. Trade or fictitious names may be referenced by using "t/a \_ \_ \_," but bids shall be in the legal name of the person or entity submitting the bid.
- (c) Bids with the bid guarantee shall be enclosed in a sealed envelope which shall be marked and addressed as indicated by the advertisement. If a Contract is for one hundred twenty thousand

dollars (\$120,000) or more, or if the total value of all construction, removal, repair or improvements undertaken by the bidder within any twelve-month period is seven hundred fifty thousand dollars (\$750,000) or more, the bidder is required under Code of Virginia §§ 54.1-1100, *et seq.*, to be licensed in Virginia as a "Class A Contractor." If a Contract is for ten thousand dollars (\$10,000) or more, but less than one hundred twenty thousand dollars (\$120,000), or if the total value of all construction, removal, repair or improvements undertaken by the bidder within any twelve-month period is one hundred fifty thousand dollars (\$150,000) or more, but less than seven hundred fifty thousand dollars (\$750,000), the bidder is required to be licensed in Virginia as a "Class B Contractor." The bidder shall place on the outside of the envelope containing the bid and shall place in the bid over its signature whichever of the following notations is appropriate and insert its Contractor license/registration number:

Licensed Class A Virginia Contractor No. \_\_\_\_\_

or

Licensed Class B Virginia Contractor No. \_\_\_\_\_

If the bidder is not properly licensed in Virginia at the time the bid is submitted, or if the bidder fails to provide this information on its bid or on the envelope containing the bid and fails to promptly provide said Contractor license number to the Owner in writing when requested to do so before the opening of bids, the bidder shall be deemed to be in violation of Code of Virginia § 54.1-1115 and its bid will not be considered.

- (d) Following guidance from the Board for Contractors, the Owner may, as a part of determining whether the bidder is "responsible," require the apparent low bidder to submit a listing of its Subcontractors along with the license number and classification or specialty of each. *See* DEP'T OF PROF'L AND OCCUPATIONAL REGULATION, BD. FOR CONTRACTORS POLICIES & INTERPRETATIONS, No. 2959 (July 11, 2016) ("A licensed contractor may bid on work, or enter into a contract for work, which is outside the scope of [its] license classification(s) provided that [it] subcontracts that work, to properly licensed contractors, and the work of the subcontractors is incidental to the contract.").
- (e) The bidder must place its Employer Identification Number (SSN or FEIN) in the space provided on the Bid Form.
- (f) Every bidder organized as a stock or nonstock corporation, limited liability company, business trust, or limited partnership or registered as a registered limited liability partnership must be authorized to transact business in the Commonwealth as a domestic or foreign business entity if so required by Title 13.1 or Title 50 of the Code of Virginia, as amended, or as otherwise required by law. Any bidder organized or authorized to transact business in the Commonwealth pursuant to Title 13.1 or Title 50 must include in its bid the identification number issued to it by the State Corporation Commission. Any bidder that is not required to be authorized to transact business in the Commonwealth as a foreign business entity under Title 13.1 or Title 50 or as otherwise required by law shall include in its bid or proposal a statement describing why the bidder is not required to be so authorized. A bidder required to be authorized to transact business in Virginia that fails to provide the required information shall not receive an award unless a waiver of this requirement and of any administrative policies and procedures established to implement Code of Virginia § 2.2-4311.2 is granted by the chief executive of the Owner.

If awarded the Contract, the bidder shall not allow its existence to lapse or its certificate of authority or registration to transact business in the Commonwealth, if so required under Title 13.1 or Title 50, to be revoked or cancelled at any time during the term of the Contract. Doing so shall be deemed to be a violation of Code of Virginia § 2.2-4311.2 and the bidder understands and agrees that the Owner may void the Contract if the bidder fails to comply with this provision.

- (g). *Code of Virginia, § 2.2-4376.2* shall be applicable to the Work of the Contract.

**5. BID GUARANTEE:**

- (a) Any bid (including the Total Base Bid plus all Additive Bid Items) which exceeds five hundred thousand dollars (\$500,000) shall be accompanied by a Commonwealth of Virginia Standard Bid Bond, Form CO-10.2, payable to the Owner as obligee in an amount equal to five percent (5%) of the amount of the bid (the "Bid Bond"). The Owner agrees to accept a Bid Bond on which the Surety has utilized electronic signatures and/or electronic notarization if the electronic notarization meets the requirements of *Virginia Code* §§ 47.1-6.1, -7, and -12, and the Commonwealth of Virginia State Corporation Commission Bureau of Insurance and the Bid Bond contains any SURETY BOND SEAL ADDENDUM established by the Commonwealth of Virginia State Corporation Commission Bureau of Insurance. For construction contracts up to \$500,000, where bid bond requirements have been waived by Owner as stated in the IFB, prospective Contractors may be prequalified in accordance with *Code of Virginia* § 2.2-4317.A Bid Bond may be required for Contracts having bids of up to five hundred thousand dollars (\$500,000) if such requirement is stated in the IFB. The Bid Bond must be issued by a surety company which is legally authorized by the Virginia State Corporation Commission to do surety business in the Commonwealth of Virginia. Such Bid Bond shall guarantee the following: that the bidder will not withdraw its bid during the thirty (30) day period following the date of the opening of bids; that if the bid is accepted, the bidder will enter into the Contract with the Owner described in the IFB; that the bidder can and will submit a properly executed and authorized Standard Performance Bond and Standard Labor and Material Payment Bond on the forms included in the IFB. If the bidder withdraws its bid within the thirty (day) period following bid opening, fails to enter into the Contract, or fails to provide the required Standard Performance Bond and Standard Labor and Material Payment Bond within ten (10) days after the bidder's receipt of notice of acceptance of its bid, the bidder and the bidder's surety shall be jointly and severally be liable to the Owner for the difference between the amount specified in the bidder's bid and such larger amount for which the Owner may contract with another party to perform the work covered by said bid, up to the amount of the bid guarantee of 5% of the bidder's total bid amount, as the damage to the Owner resulting from the bidder's default. See *Code of Virginia* §2.2-4336.
- (b) *Code of Virginia* § 2.2-4338 contains provisions allowing for alternative forms of bid security in lieu of a Bid Bond. A bidder's use of an alternative form of Security as listed in *Code of Virginia* § 2.2-4338.B must be approved by the Owner prior to the bidder's submission of its bid on the Bid Receipt date and time to be accepted in lieu of a Bid Bond.
- (c) The Bid Bond or other alternative bid security will be returned to all but the three lowest bidders after the formal opening of bids. The remaining Bid Bonds or bid security will be returned to the bidders after the Owner and the accepted bidder have executed the Contract and the required Standard Performance Bond and the Standard Labor and Material Payment Bond for the Contract have been received and approved by the Owner.
- (d) If the Contract and required bonds have not been executed by the accepted bidder within thirty (30) days after the date of the opening of the bids, then the Bid Bond or other bid security of any bidder will be returned upon a bidder's request, provided the bidder has not been notified of the acceptance of its bid prior to the date of such request.

**6. WITHDRAWAL OR MODIFICATION OF BIDS:** Bids may be withdrawn or modified by written or telefaxed notice received at the designated location from bidders prior to the deadline fixed for bid receipt. E-mail withdrawals and modifications are not acceptable. The withdrawal or modification may be made by the person who signed the bid or by an individual(s) who is authorized by the bidder on the face of the bid. Written modifications may be made on the bid form itself, on the envelope in which the bid is enclosed, or on a separate document. Written modifications, whether the original is delivered or telefaxed, must be

signed by the person making the modification or withdrawal. The modification must state specifically what is to be modified and by what amount or it must state the item to be modified and what the corrected amount should be.

**7. RECEIPT OF BIDS:**

- (a) **Bids will be received at or before the date and the hour and at the place stipulated in the IFB as may be modified by subsequent Addenda.**
- (b) **It is the responsibility of the bidder to assure that its bid and any bid modifications are delivered to the place designated for receipt of bids by the date and hour (deadline) set for receipt of bids. Therefore, it is the bidder's responsibility to take into account all factors which may impact on its bid deliverer / courier's ability to deliver the bid and to implement whatever actions are necessary to have the bid delivered to the proper bid receipt location prior to the bid receipt deadline.** No bids or bid modifications submitted or offered after the date and hour designated for receipt of bids will be accepted or considered.
- (c) The Bid Officer is the Owner's representative designated to receive bids at the time and place noted in the IFB and to open the bids received at the appointed time.
- (d) **The official time used for the receipt of responses is determined by reference to the clock designated by the Bid Officer.** The Bid Officer shall determine when the Bid Receipt Deadline has arrived and shall announce that the Deadline has arrived and that no further bids or bid modifications will be accepted. All bids and bid modifications in the possession of the Bid Officer and their assistants at the time the announcement is completed are deemed to be timely, whether or not the bid envelope has been physically date/time stamped or otherwise marked by the time the Bid Officer makes the deadline announcement.
- (e) In the event the bid receipt occurs during a period of suspended state business operations, the receipt and opening will be delayed one business day.

**8. OPENING OF BIDS:**

- (a) Bids will be opened at the time and place stated in the IFB or as modified by subsequent Addenda, and their contents publicly announced. The Bid Officer shall decide when the specified time for bid opening has arrived. No responsibility will be attached to any officer or agent for the premature opening of a bid not properly addressed and identified. Bid opening shall be no sooner than twenty-four (24) hours after the time set for receipt of bids.
- (b) The provisions of Code of Virginia § 2.2-4342, as amended, shall be applicable to the inspections of bids received.
- (c) In the event the bid opening occurs during a period of suspended state business operations, the opening will be delayed until the next business day.

**9. ERRORS IN BIDS:** A bidder may withdraw its bid from consideration if the price bid was substantially lower than the other bids due solely to a mistake therein, provided the bid was submitted in good faith, and the mistake was a clerical mistake as opposed to a judgment mistake, and was actually due to an unintentional arithmetic error or an unintentional omission of a quantity of work, labor or material made directly in the compilation of a bid, which unintentional arithmetic error or unintentional omission can be clearly shown by objective evidence drawn from inspection of original work papers, documents and materials used in the preparation of the bid sought to be withdrawn.

In accordance with Code of Virginia § 2.2-4330(B)(2), the bidder must submit to the Owner its original work papers, documents and materials used in the preparation of the bid within one day after the date fixed for submission of bids. Such work papers must be submitted in an envelope or package separate and apart

from the envelope containing the bid and marked clearly as to the contents and shall be delivered to the Owner by the bidder in person or by registered mail prior to the time fixed for the opening of bids and may not be withdrawn until after the two-hour period (referred to later) has elapsed. The bids shall be opened at the time designated in the IFB, as amended by addendum. Bid opening is usually one day following the time fixed by the Owner for the submission of bids, but no sooner. Once the bids have been opened, the bidder shall have two (2) hours after the opening of bids within which to claim in writing any mistake as defined herein and withdraw its bid. The Contract shall not be awarded by the Owner until such two-hour period has elapsed. Such mistake shall be proved only from the original work papers, documents and materials delivered to the Owner prior to bid opening. This procedure in Code of Virginia § 2.2-4330(B)(2) shall not apply to when the entire bid is required to be submitted on a unit price basis.

Failure of a bidder to submit its original work papers, documents and materials used in the preparation of its bid on or before the time, date and place required shall constitute a waiver by that bidder of its right to withdraw its bid due to a mistake.

No bid may be withdrawn under this section when the result would be the awarding of the Contract on another bid of the same bidder or of another bidder in which the ownership of the withdrawing bidder is more than five (5%) percent.

No bidder who is permitted to withdraw a bid shall, for compensation, supply any material or labor to or perform any subcontract or other work agreement for the person or firm to whom the Contract is awarded or otherwise benefit, directly or indirectly, from the performance of the project for which the withdrawn bid was submitted. The person or firm to whom the Contract was awarded and the withdrawing bidder are jointly liable to the Owner in an amount equal to any compensation paid to or for the benefit of the withdrawing bidder without such approval.

If the apparent low bid is withdrawn under authority of this section, the lowest remaining bid shall be deemed to be the low bid on the project.

- 10. REJECTION OF BIDS:** The Owner reserves the right to cancel the IFB, to reject any and all bids at its sole discretion when such rejection is in the interest of the Owner, or to reject the bid of any bidder who is determined to be not responsive or not responsible. *See* Code of Virginia § 2.2-4319.

**11. DETERMINATION OF RESPONSIBILITY**

Each bidder shall be prepared, if so requested by the Owner, to present evidence of its experience, qualifications and financial ability to carry out the terms of the Contract.

Prior to award of the Contract, an evaluation will be made to determine if the low bidder has the capability, in all respects, to perform fully the contract requirements and the moral and business integrity and reliability which will assure good faith performance, and who has been prequalified, if required. Factors to be evaluated include, but are not limited to:

- (a) sufficient financial ability to perform the contract as evidenced by the bidder's ability to obtain payment and performance bonds from an acceptable surety;
- (b) appropriate experience to perform the Work described in the bid documents;
- (c) any judgments entered against the bidder, or any officers, directors, partners or owners for breach of a contract for construction;
- (d) any substantial noncompliance with the terms and conditions of prior construction contracts with a public body without good cause where the substantial noncompliance is documented; or
- (e) a conviction of the bidder or any officer, director, partner, project manager, procurement manager, chief financial officer, or owner in the last five years of a crime relating to governmental or nongovernmental construction or contracting; and/or

- (f) any current debarment of the contractor, any officer, director or owner, from bidding or contracting by any public body of any state, any state agency, or any agency of the federal government.

The Owner reserves the right to disqualify or refuse to accept the bid of any bidder who has been convicted, or entered a plea of guilty or nolo contendere, in any federal or state court to any charge involving any unlawful, corrupt or collusive practice involving a public contract whether federal, state, or local, or who has been determined in any judicial proceeding to have violated any antitrust, bid-rigging or collusive practice statute in connection with any public contract, or against whom such formal criminal prosecution or other judicial proceeding has been initiated.

A bidder who, despite being the apparent low bidder, is determined not to be a responsible bidder shall be notified in writing in conformance with the procedures in Code of Virginia § 2.2-4359.

## 12. AWARD OF CONTRACT

- (a) **Basis for Contract Award:** The Contract, if awarded, will be awarded to the lowest responsive and responsible bidder, if any, provided its bid is reasonable and it is in the best interest of the Owner to accept it and subject to the Owner's right to reject any and all bids and to waive informality in the bids and in the bidding. The Bid Form contains a multi-part Base Bid and may contain Additive Bid Items. Determination of the lowest responsible bidder, if any, will be based on the Total Base Bid Amount **entered on the Bid Form** including any properly submitted bid modifications plus as many Additive Bid Items taken in sequence as the Owner in its discretion chooses to Award. **Where the sum of the values entered in the multiple parts do not agree with the Total Base Bid amount, the Total Base Bid amount entered on the bid form, including any properly submitted bid modifications, shall take precedence.**

In the event that the Total Base Bid from the lowest responsible bidder exceeds available funds, the Owner may negotiate the Total Base Bid amount with the apparent low bidder to obtain a Contract Price within available funds, pursuant to Code § 2.2-4318 and Section 12(c) herein.

- (b) **Informalities:** The Owner reserves the right to waive any informality in the bids when such waiver is in the interest of the Owner.
- (c) **Negotiation With Lowest Responsible Bidder:** If award of the Contract to the lowest responsive and responsible bidder is precluded because of limitations on available funds, under the provisions of Code § 2.2-4318 the Owner reserves the right to negotiate the Total Base Bid amount with the lowest responsive, responsible bidder to obtain a Contract Price within the available funds. This may involve changes in either the features or scope of the work included in the Base Bid. Such negotiations with the apparent low bidder may include reducing the quantity, quality, or other cost saving mechanisms involving items in the Total Base Bid. Negotiations for Additive Bid Items are excluded. The Owner shall notify the lowest responsive and responsible bidder that such a situation exists and the Owner and bidder shall then conduct their negotiations in person, by mail, by telephone or by any means they find convenient. If an acceptable Contract can be negotiated, any changes to the IFB documents agreed upon in the negotiations shall be summarized in a "Post Bid Modification" and included in the Contract. If an acceptable Contract cannot be negotiated, the Owner shall terminate negotiations and reject all bids.
- (d) **Notice of Intent to Award or Notice of Award:** The Notice of Award or the Notice of Intent to Award will be posted at the Agency's standard location for posting notices **as shown on the "Notice of Invitation to Bid"**. In addition, the Agency may also post such notice on the Agency's Website and/or the DGS central electronic procurement Website. Any bidder who desires to protest the award or decision to award a contract shall submit the protest in writing to the public body no later than ten days after the posting of the Notice of Award or Notice of Intent to Award, whichever comes first. *See* Code of Virginia § 2.2-4360.

13. **CONTRACT SECURITY:** For contracts which exceed five hundred thousand dollars (\$500,000), the Standard Performance Bond (CO-10) and the Standard Labor and Material Payment Bond (CO-10.1) shall be required, as specified in the IFB. For construction contracts up to \$500,000, where Bid Bond requirements are waived, prospective contractors may be prequalified in accordance with Code of Virginia § 2.2-4317. See General Conditions and Code of Virginia § 2.2-4337 and § 2.2-4338. The Owner reserves the right to require such bonds for contracts up to five hundred thousand dollars (\$500,000). If the Owner so elects, the requirement shall be set forth in the IFB.
14. **CERTIFICATION:** The bidder, by its signature on the Bid Form, certifies that neither its organization nor any of its officers, directors, partners or owners is currently barred from bidding on contracts by any Agency of the Commonwealth of Virginia, or any public body or agency of another state, or any agency of the federal government. See "Disqualification of Contractors" in the Bid Form.
15. **ETHICS IN PUBLIC CONTRACTING:** The provisions, requirements and prohibitions as contained in Code of Virginia §2.2-4367 *et seq.*, pertaining to bidders, offerors, contractors, and subcontractors are applicable to this project.
16. **BUILDING PERMITS:** Because this is a Project of the Commonwealth of Virginia, codes or zoning ordinances of local political subdivisions do not apply. However, the Virginia Uniform Statewide Building Code shall apply to the Work and shall be administered by the Building Official for State-owned Buildings. The Building Permit will be obtained and paid for by the Owner. All other permits, local license fees, business fees, taxes, or similar assessments imposed by the appropriate political subdivision shall be obtained and paid for by the Contractor. See Section 25 of the General Conditions for utility connection fees and services.
17. **UTILIZATION OF SMALL BUSINESSES:** It is the policy of the Commonwealth of Virginia to maximize the participation of small businesses in state contracting. The participation of these businesses directly and through partnerships, joint ventures, subcontracts and other contractual opportunities may be encouraged for this Project based on the Owner's requirements (if applicable) on the Bid Form. Bidders shall provide a Small Business Procurement Plan in conjunction with their sealed bid. The Small Business Procurement Plan shall identify the bidder's proposed percentage of participation by small businesses in the Total Base Bid amount, and is indicated on the Bid Form. An entry on the line for "Contractor's Proposed Small Business Participation" is required for the bid to be considered responsive. If the bidder is a DSBSD certified small business, the proposed percentage of small business participation shall be entered as 100%. A bidder may enter a proposed percentage of small business participation of 0% and be considered responsive unless the Bid Form states that the Owner requires a specific percentage of small business participation, in which case the bidder shall enter a percentage equal to or greater than the Owner's required small business participation percentage for the bid to be considered responsive.
18. **BID DOCUMENTS:** Bid Documents are the property of the Owner and a deposit in an amount as stated in the Invitation for Bids is required for each paper set or for each set provided on removable electronic media as a guarantee of the safe return of the documents within ten (10) days of bid opening. This deposit will be refunded in full on not more than two paper sets or sets provided on removable electronic media to each bidder who submits a Contract bid and who returns the documents in good condition. Refund will be made on paper sets and sets provided on removable electronic media to non-bidders and Subcontractors in the amount of half of the deposit when the sets are returned in good condition within 10 days. A deposit is not required for downloading of electronic construction documents through an FTP site. A non-refundable shipping charge may be required for paper sets or sets provided on removable electronic media if stated in the Notice or the IFB.
19. **GENERAL CONDITIONS:** The General Conditions are incorporated in the bid documents. If a copy of the General Conditions is not included in the bid documents, the bidder may obtain a copy of the current edition of the General Conditions at no cost by written request to the A/E and/or the Agency where the bid

documents are obtained. Copies may also be obtained from the DGS Forms Center (available online at <http://forms.dgs.virginia.gov>).

20. **PREBID CONFERENCE:** See the IFB for requirements for a prebid conference and whether such conference is mandatory or optional.
21. **INSPECTION OF BID DOCUMENTS:** Copies of the IFB documents including Plans and Specifications and the General Conditions will be available for inspection at the Agency, at the A/E's office, and at the locations listed in the Notice of the IFB.
22. **DRUG-FREE WORKPLACE REQUIRED:** Bidders are reminded that Code of Virginia § 2.2-4312 requires that the during the performance of the Contract resulting from this solicitation, the Contractor agrees to: (i) provide a drug-free workplace for the Contractor's employees; (ii) post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is prohibited in the Contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition; (iii) state in all solicitations or advertisements for employees placed by or on behalf of the Contractor that the Contractor maintains a drug-free workplace; and (iv) include the provisions of the foregoing clauses in every Subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each Subcontractor or vendor.

For the purposes of this section, "drug-free workplace" means a site for the performance of work done in connection with a specific Contract awarded to a Contractor in accordance with this solicitation, the employees of whom are prohibited from engaging in the unlawful manufacture, sale, distribution, dispensation, possession or use of any controlled substance or marijuana during the performance of the contract.

**NOTE:** These CO-7A, Instructions to Bidders, have been created specifically for the use of agencies of the Commonwealth of Virginia, which may not alter their provisions without the express written approval of the Virginia Department of General Services, Division of Engineering and Buildings. These Instructions to Bidders have significant legal implications and shall not be altered or modified. Nothing in the CO-7A, Instructions to Bidders, shall be amended or deleted or its intent changed, except by an approved and properly issued 'Supplemental Instruction to Bidders'. The Commonwealth makes no representation as to their suitability for any other purpose. Paragraphs which have been added or revised since prior edition are identified with a line to the left of the paragraph.

**DGS-30-272**

(Rev. 04/15)

**PREBID QUESTION FORM**

(Use separate Form for each question submitted.)

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

**Project Title:** VWCC Renovate Chapman Hall Enrollment Center

**Project Code No.:** 260-B5260-019

The following question concerns Drawing Sheet (number)\_\_\_\_\_:

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The following question concerns Specifications Section (number)\_\_\_\_\_, page \_\_\_\_\_, paragraph \_\_\_\_\_:

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**Question submitted by:**\_\_\_\_\_

Name

Organization

**Bidders shall submit form to:**

Nathan Harper [nharper@spectrumpc.com](mailto:nharper@spectrumpc.com)

And [build@spectrumpc.com](mailto:build@spectrumpc.com)



**COMMONWEALTH of VIRGINIA**  
**DEPARTMENT OF LABOR AND INDUSTRY**

**Gary G. Pan**  
COMMISSIONER

Main Street Centre  
600 East Main Street, Suite 207  
Richmond, Virginia 23219  
PHONE (804) 371-2327  
FAX (804) 371-6524

Virginia Department of Labor and Industry Wage Determination Decision

Project Name Virginia Western Community  
College, Renovate Chapman Hall  
Enrollment Center

State Project Code 260-B5260-019 (L25VW573)

DOLI Project Number VCCS-25-0078

County or Independent City Roanoke (City)

Publication Date 12/03/2025

Construction Type Building

Wage Determinations	Wage	Fringe
Asbestos Worker/Heat & Frost Insulator (Duct, Pipe & Mechanical System Insulation)*	\$40.77	\$20.17
Boilermaker	\$38.97	\$27.39
Bricklayer	\$23.87	\$6.81
Carpenter	\$13.49	\$1.10
Electrician	\$21.78	\$9.31
Glazier	\$16.95	\$2.48
Ironworker, Ornamental and Structural	\$37.86	\$25.86
Ironworker, Reinforcing	\$25.36	\$6.68

Wage Determinations	Wage	Fringe
Laborer: Common or General, Including Mason Tender - Brick and Cement, and Pipelaying	\$15.15	\$1.58
Operator: Backhoe/Excavator/Trackhoe	\$16.24	\$0.87
Operator: Bobcat/Skid Steer/Skid Loader	\$18.95	\$4.03
Operator: Bulldozer	\$16.00	
Operator: Forklift	\$19.40	\$7.00
Operator: Loader	\$21.28	\$3.17
Painter (Brush and Roller)	\$20.01	
Painter (Spray Only)	\$29.16	\$11.86
Pipefitter	\$24.98	\$9.14
Plumber	\$21.15	\$3.92
Power Equipment Operator: Cranes 90 Tons & Over capacity; Tower & Climbing Cranes with Controls 100 ft. Above Ground	\$40.99	\$18.05
Power Equipment Operator: Cranes Under 90 Tons	\$39.99	\$18.05
Roofer	\$16.17	\$3.73
Sheet Metal Worker, Includes HVAC Duct Installation	\$18.38	\$3.30
Tile Finisher	\$23.40	
Tile Setter	\$27.80	\$10.25
Truck Driver: Dump Truck	\$16.58	\$1.73

## Additional Notes

\* Asbestos Worker/Heat & Frost Insulator (Duct, Pipe & Mechanical System Insulation) \* PAID HOLIDAYS: New Year's Day, Martin Luther King Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, the day after Thanksgiving and Christmas Day provided the employee works the regular work day before and after the paid holiday. \*

All wage rates to be used on a contract will be set at the time the contract is awarded. While DOLI maintains a list of wage determinations online for reference purposes, only the wage determinations made in an official Wage Determination Decision, sent by DOLI to the contracting agency, can be used to ascertain the exact rates to be paid for a specific contract.

All rates are determined by DOLI and any appeals of specific classifications may be made through the Wage Determination Appeal form available at <https://doli.virginia.gov/wp-content/uploads/2022/05/Appeal-for-Clarification-of-Wage-Determination.pdf>

Any additional classifications may be requested through the Additional Wage Classification form available at <https://doli.virginia.gov/wp-content/uploads/2022/05/Appeal-for-Clarification-of-Wage-Determination.pdf>

Understand your duties as a contractor under Virginia law by referencing our Contractor Responsibilities information sheet available at <https://doli.virginia.gov/prevaling-wage-law/#CR>

Your employees have specific rights, which can be found on our List of Employee Rights information sheet available at <https://doli.virginia.gov/prevaling-wage-law/#ERB>

Any further questions should be directed to [PrevailingWage@doli.virginia.gov](mailto:PrevailingWage@doli.virginia.gov)



**DEB Notice 051721**  
( Effective: 05/01/2021 )

**Prevailing Wage  
Wage Determination by the Department of Labor and Industry (DOLI)**

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**I. Purpose of this Notice:**

Pursuant to *Code of Virginia* § 2.2-4321.3, beginning May 1, 2021, each State Agency shall ensure that its bid specifications or other public contracts require bidders, offerors, contractors, and subcontractors to pay wages, salaries, benefits, and other remuneration to any mechanic, laborer, or worker employed, retained, or otherwise hired to perform services in connection with the public contract for public works at the prevailing wage rate.

**II. Related Construction & Professional Services Manual (CPSM) Revisions:**

Section 7.0.1.3 is hereby added to the 2020 Edition of the CPSM, dated July 1, 2020.

**III. Applicability:**

COV Section 2.2-4321.3, "Payment of prevailing wage for work performed on public works contracts" is effective May 1, 2021. *The General Conditions of the Construction Contract* (CO-7, CO7-DB and CO-7CM), April 2021 edition, includes these requirements under Section 3(m) Laws and Regulations and is available to download from the [DEB Forms Center](#). Beginning May 1, 2021, prevailing wage requirements shall be included in solicitations for projects valued at more than \$250,000. The Wage Determination for prevailing wage rates obtained from the Department of Labor and Industry shall be added to the Project Manual immediately following the Instructions to Bidders (CO-7a) or in the Request for Proposals for each project that requires payment of prevailing wage.

### 7.0.1.3 Prevailing Wage

In accord with *Code of Virginia* [§ 2.2-4321.3](#), the Prevailing Wage law mandates the rates of pay, benefits and other remuneration and duties of certain public officials under contracts and subcontracts for public works in Virginia. The Prevailing Wage law, effective May 1, 2021, applies to contracts for public works paid for in whole or in part by state funds, valued at more than \$250,000 when the contracting public body is a unit of State Government or an instrumentality of the State, and there is any State funding for the project. Public works means the operation, erection, construction, alteration, improvement, maintenance, or repair of any public facility or immovable property owned, used, or leased by a state agency or locality.

Under § 2.2-4321.3 the prevailing wage rate for public works is established by the Commissioner of Labor and Industry. [The Department of Labor and Industry \(DOLI\)](#) makes a copy of the General Wage Determinations for Virginia available publicly on its website, and updates it periodically. **However, only an official, project specific Wage Determination from DOLI sent to a contracting agency conducting a public works project shall be used for official purposes.**

The Agency, at least ten (10) but not more than twenty (20) days prior to the date the bid or RFP will be advertised or solicited, shall contact DOLI at [prevailingwage@doli.virginia.gov](mailto:prevailingwage@doli.virginia.gov) to request the Wage Determination for the project and provide:

- Project Name
- State Project Code
- Location of Project (county or independent city)
- DOLI Construction Type (Building, Residential, Highway, Heavy)

DOLI will respond with an official Wage Determination. The contracting Agency shall include that official Wage Determination in the Project Manual immediately following the Instructions to Bidders (CO-7a) or in the Request for Proposals with the following statement:

*Rates of pay, benefits and other remuneration for this contract shall utilize the wage determinations listed in the following Wage Determination from the Virginia Department of Labor and Industry for the purposes of compliance with Section 3 m of the General Conditions (CO-7 series) "Payment of Prevailing Wages Pursuant to Virginia Code 2.2-4321.3".*

For Construction Management projects, the contracting Agency shall provide an official, project specific Wage Determination to the Construction Manager at Risk for use in development of the Guaranteed Maximum Price (GMP) proposal. Such determination shall be requested by the contracting Agency from DOLI at least ten (10) but not more than twenty (20) days prior to the date that the CM will advertise for subcontractor bids.

At contract award, the contracting Agency shall contact DOLI to determine if modification is required to the official Wage Determination. Changes to the official Wage Determination shall be incorporated into the contract by change order.

**DGS-30-272**

(Rev. 04/15)

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**BID FORM**

DATE: \_\_\_\_\_

PROJECT: Virginia Western Community College  
Renovate Chapman Hall Enrollment  
Center  
3094 Colonial Avenue, SW  
Roanoke, Virginia 24015

Project Code: 260-B5260-019 (L24VW573)

To: Commonwealth of Virginia  
Virginia Community College System  
Attn: Sibyl Roberts  
300 Arboretum Place, Suite 200  
Richmond VA 23236

In compliance with and subject to your Invitation for Bids and the documents therein specified, all of which are incorporated herein by reference, the undersigned bidder proposes to furnish all labor, equipment, and materials and perform all work necessary for construction of this project, in accordance with the Plans and Specifications dated November 14, 2025 and the Addenda noted below, as prepared by Spectrum Design, P.C., 10 Church Avenue SE, Roanoke, Virginia 24011, for the consideration of the following amount:

**BASE BID (including the following parts but excluding work in Additive Bid Items):**

**PART A.**

Lump sum price for all work, complete and in accordance with the Plans and Specifications:

**PART A =** \_\_\_\_\_ Dollars (\$ \_\_\_\_\_)

**TOTAL BASE BID AMOUNT (Sum of PART A) IS:**

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

Contract award will be based on the **TOTAL BASE BID AMOUNT shown above** (including any properly submitted bid modifications) plus as many Additive Bid Items taken in sequence as the Owner in its discretion decides to award.

**Mechanical Controls:**

The undersigned agrees that it will use as the subcontractor for Work under Section 230923 DDC System for HVAC, and subsequent Section 230923.23 and Section 230923.27, and for related Work shown on the Drawings, BAS Control Systems, 8420 Meadowbridge Rd., Suite C, Mechanicsville, VA 23116, Tel. (804) 569-2473, Contact: Nick Goslin, a subcontractor selected by the Owner, **for a subcontract price of \$23,900**, and that this quote has been included in the **TOTAL BASE BID AMOUNT** above. The undersigned agrees that it will be responsible for this subcontractor and its work just as if it had been selected by the undersigned.

**Electrical Controls:**

The undersigned agrees that it will use as the subcontractor for Work defined on Drawing E102, titled "LIGHTING NARRATIVE FOR BAS LIGHTING CONTROL SYSTEM", and for related Work shown elsewhere on the Drawings and required within the Project Manual, BAS Control Systems, 8420 Meadowbridge Rd., Suite C, Mechanicsville, VA 23116, Tel. (804) 569-2473, Contact: Nick Goslin, a subcontractor selected by the Owner, **for a subcontract price of \$135,000**, and that this quote has been included in the **TOTAL BASE BID AMOUNT** above. The undersigned agrees that it will be responsible for this subcontractor and its work just as if it had been selected by the undersigned.

The bidder has relied upon the following public historical climatological records for NOAA for Roanoke, VA.

*Code of Virginia, § 2.2-4376.2* shall be applicable to the Work of the Contract.

The undersigned understands that time is of the essence and agrees that the time for Substantial Completion of the entire project shall be **240** consecutive calendar days from the date of commencement of the Work as specified in the Notice to Proceed, and Final Completion shall be achieved within 30 consecutive calendar days after the date of Substantial Completion as determined by the A/E. The project mobilization is proposed to start April 1, 2026.

Acknowledgment is made of receipt of the following Addenda: \_\_\_\_\_  
\_\_\_\_\_.

If notice of acceptance of this bid is given to the undersigned within 30 days after the date of opening of bids, or any time thereafter before this bid is withdrawn, the undersigned will execute and deliver a contract in the prescribed form (Commonwealth of Virginia Contract Between Owner and Contractor, Form CO-9) within 10 days after the contract has been presented to him for signature. The required payment and performance bonds, on the forms prescribed, shall be delivered to the Owner along with the signed Contract.

Immigration Reform and Control Act of 1986: The undersigned certifies that it does not and shall not during the performance of the Contract for this project violate the provisions of the Federal Immigration Reform and Control Act of 1986, which prohibits employment of illegal aliens, or knowingly employ an unauthorized alien as defined in the Federal Immigration Reform and Control Act of 1986.

**DISQUALIFICATION OF CONTRACTORS:** By signing this bid or proposal, the undersigned certifies that this Bidder or any officer, director, partner or owner is not currently barred from bidding on contracts by any Agency of the Commonwealth of Virginia, or any public body or agency of another state, or any agency of the federal government, nor is this Bidder a subsidiary or affiliate of any firm/corporation that is currently barred from bidding on contracts by any of the same. We have attached an explanation of any previous disbarment(s) and copies of notice(s) of reinstatement(s).

Either the undersigned or one of the following individuals, if any, is authorized to modify this bid prior to the deadline for receipt of bids by writing the modification and signing his name on the face of the bid, on the envelope in which it is enclosed, on a separate document, or on a document which is telefaxed to the Owner:

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

I certify that the firm name given below is the true and complete name of the bidder and that the bidder is legally qualified and licensed by the Virginia Department of Professional and Occupational Regulation, Board for Contractors, to perform all Work included in the scope of the Contract.

Virginia License No.: \_\_\_\_\_

Bidder: \_\_\_\_\_  
(Name of Firm)

Contractor Class: \_\_\_\_\_

By: \_\_\_\_\_  
(Signature)

Specialty: \_\_\_\_\_

Valid until: \_\_\_\_\_

FEIN/SSN: \_\_\_\_\_

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

If General Partnership (List Partners' Names)

Business Address:

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

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

Telephone # \_\_\_\_\_

FAX # \_\_\_\_\_

If Corporation, affix Corporate Seal &  
list State of Incorporation

State: \_\_\_\_\_

(Affix Seal)

Virginia State Corporation Commission ID No.: \_\_\_\_\_; or

If Contractor is a foreign business entity not required to be authorized to transact business in the Commonwealth under Titles 13.1 or 50 of the Code of Virginia, or as otherwise required by law, please provide an explanation as to why such entity is not required to be so authorized: \_\_\_\_\_

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

Contractor's Proposed Small Business Participation: (%) \_\_\_\_\_ (required)

**COMMONWEALTH OF VIRGINIA  
STANDARD BID BOND**

**KNOW ALL MEN BY THESE PRESENTS:** That \_\_\_\_\_, the Contractor (“Principal”) whose principal place of business is located at \_\_\_\_\_ and \_\_\_\_\_ (“Surety”) whose address for delivery of ‘Notices’ is located at \_\_\_\_\_ are held and firmly bound unto the Commonwealth of Virginia, \_\_\_\_\_, the Owner (“Obligee”) in the amount of five percent (5%) of the Amount (Total Base Bid plus all Additive Bid Items) Bid by Principal, for the payment whereof, Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

**WHEREAS**, the Principal has submitted a bid for \_\_\_\_\_

**NOW, THEREFORE**, the conditions of this obligation are as follows. This Bid Bond shall guarantee that the Principal will not withdraw his bid during the period of thirty (30) days following the opening of bids; that if his bid is accepted, Principal will enter into a formal contract with the Owner in accordance with the Contract Between Owner and Contractor, Form CO-9, included as a part of the Invitation for Bids (IFB Documents); that Principal will submit a properly executed and authorized Standard Performance Bond and Standard Labor and Material Payment Bond on the forms included in the IFB documents; and that in the event of the withdrawal of said bid within said period, or failure to enter into said contract and give said bonds within ten (10) days after Principal has received notice of acceptance of his bid, Principal and Surety shall be jointly and severally liable to the Owner for the difference between the amount specified in said bid and such larger amount for which the Owner may contract with another party to perform the work covered by said bid, up to the amount of the bid guarantee. This amount represents the damage to the Owner of account of the default of the bidder in any particular thereof.

The Surety represents to the Principal and to the Obligee that it is legally authorized to do business in the Commonwealth of Virginia.

Signed and sealed this \_\_\_\_\_ day of \_\_\_\_\_

\_\_\_\_\_  
*Contractor / Principal* (SEAL)

\_\_\_\_\_  
*Witness*

By: \_\_\_\_\_  
Typed Name: \_\_\_\_\_  
Title: \_\_\_\_\_

\_\_\_\_\_  
*Surety* (SEAL)

By: \_\_\_\_\_  
*Attorney-in-Fact*  
Typed Name: \_\_\_\_\_

**AFFIDAVIT AND ACKNOWLEDGEMENT OF ATTORNEY-IN-FACT**

COMMONWEALTH / STATE OF \_\_\_\_\_ )  
CITY/COUNTY/TOWN of \_\_\_\_\_

I, the undersigned notary public, do certify that \_\_\_\_\_, whose name is signed to the foregoing bid bond in the amount of five percent (5%) of the Total Bid Amount and which names the Commonwealth of Virginia, \_\_\_\_\_, as Obligee, personally appeared before me today in the above jurisdiction and made oath that he/she is the attorney-in-fact of \_\_\_\_\_, a \_\_\_\_\_ corporation which is the Surety in the foregoing bond, that he/she is duly authorized to execute on the above Surety's behalf the foregoing bond pursuant to the Power of Attorney noted above and attached hereto, and on behalf of the surety, he/she acknowledged the foregoing bond before me as the above Surety's act and deed.

She/he has further certified that her/his Power of Attorney has not been revoked.

[Complete if Power is recorded: Clerk's Office: \_\_\_\_\_;

Deed Book/Page No. or Instrument No.: \_\_\_\_\_.]

Given under my hand this \_\_\_\_\_ day of \_\_\_\_\_.

\_\_\_\_\_  
*Notary Public* (SEAL)

My name (printed) is: \_\_\_\_\_

My registration number is: \_\_\_\_\_

My commission expires: \_\_\_\_\_

COMMONWEALTH OF VIRGINIA



GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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**PLEASE NOTE:** These General Conditions of the Construction Contract (CO-7) (“General Conditions”), have been created specifically for the use of agencies of the Commonwealth of Virginia, which may not alter any provisions without the express written approval of the Virginia Department of General Services, Division of Engineering and Buildings. The General Conditions have significant legal implications and shall not be altered or modified. Nothing in the General Conditions shall be amended or deleted or its intent changed, except by an approved and properly issued Supplemental General Conditions. The Commonwealth of Virginia makes no representation as to their suitability for any other purpose. Note: Governmental entities not subject to DGS purview intending to modify the General Conditions for their use should consult with their legal counsel.

## 1. DEFINITIONS

Whenever used in in the Contract Documents, the following terms have the meanings indicated, which are applicable to both the singular and plural variations thereof:

**Agency:** The Agency, institution or department which is a party to the Contract. For purposes of the Contract, the term Owner shall include such Agency, whether or not the Agency owns the site or the building.

**A/E Services:** The entirety of the services required of the A/E pursuant to the A/E's contract with the Owner for the Project.

**As-Built Drawings:** The As-Built Drawings is a set of all Drawings, Specifications, addenda, approved Shop and setting Drawings, Change Orders and other modifications which are updated by the Contractor throughout the performance of the Work to contemporaneously record all changes and variations made during construction. The representation of such variations shall be neatly and clearly marked in color and shall include such supplementary notes, symbols, legends, and details as may be necessary to clearly show the as-built construction of the Work.

**Architect/Engineer ("A/E"):** The Virginia licensed Architect or Engineer that contracts with the Owner to provide the A/E Services for the Project. The A/E is a separate contractor and not an agent of the Owner. The term includes any subcontractors, associates or consultants employed by the A/E to assist in providing the A/E Services.

**Beneficial Occupancy:** The time, following Substantial Completion, at which the Project or portion thereof, is sufficiently complete and systems operational such that the Owner could, after obtaining necessary approvals and certificates, occupy and utilize the space for its intended use. Guarantees and warranties applicable to that portion of the Work begin on the date the Owner accepts and occupies the Project, or a portion thereof, unless otherwise specified in the Supplemental General Conditions or by separate agreement.

**Change Order:** A document (CO-11) issued on or after the effective date of the Contract which is agreed to by the Contractor and approved by the Owner, and which authorizes an addition, deletion or revision in the Work, including any adjustment in the Contract Price and/or the Contract Completion Date. The term Change Order shall also include initiating and confirming change orders issued pursuant to Section 38(a)(3). A Change Order, once signed by all parties, is incorporated into and becomes a part of the Contract.

**Code of Virginia:** *Code of Virginia* (1950), as amended. Sections of the Code referred to herein are noted by § xx-xx.

**Commissioner of Labor and Industry:** The Commonwealth of Virginia Commissioner of Labor and Industry.

**Construction:** The term used to include new construction, reconstruction, renovation, restoration, major repair, demolition and all similar work upon buildings and ancillary facilities, including any draining, dredging, excavation, grading or similar work upon real property.

**Contract:** The Contract between Owner and Contractor, (CO-9 series) and the Contract Documents incorporated therein.

**Contract Completion Date:** The date by which the Work must achieve Substantial Completion. The Contract Completion Date is established in the Notice to Proceed, based on the Time for Completion, or set forth as a specific date in the Contract.

**Contract Documents:** The Contract and any documents expressly incorporated therein. Such incorporated documents customarily include the bid submitted by the Contractor, the General Conditions, any Supplemental General Conditions, any Special Conditions, the Plans and the Specifications, and all modifications, including addenda and subsequent Change Orders.

**Contract Price:** The total compensation payable to the Contractor for performing the Work in accordance with the Contract Documents, subject to modification by Change Order.

**Contractor:** The person or entity with whom the Owner has entered into the Contract for the Work.

**Critical Path:** The longest continuous sequential duration of dependent activities from the Date of Commencement to the Contract Completion Date that defines the minimum overall time necessary to complete the Project, such that a delay of any activity along the Critical Path will result in a delay of the Contract Completion Date unless the duration of a subsequent activity on the Critical Path is reduced to offset the delay and maintain the Contract Completion Date.

**Date of Commencement:** The date as indicated in the written Notice to Proceed, the receipt of the earliest Building Permit, or a date mutually agreed to between the Owner and Contractor in writing, whichever is the latest.

**Day:** Calendar day unless otherwise noted.

**Defective:** An adjective which, when modifying the word Work, refers to Work that is unsatisfactory, faulty, deficient, does not conform to the Contract Documents or does not meet the requirements of inspections, standards, tests or approvals required by the Contract Documents, or Work that has been damaged prior to the A/E's recommendation of Final Payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion or Beneficial Occupancy).

**DGS:** Virginia Department of General Services.

**Drawing:** A page or sheet of the Plans which presents a graphic representation, usually drawn to scale, showing the technical information, design, location, and dimensions of various elements of the Work. The graphic representations include, but are not limited to, plan views, elevations, transverse and longitudinal sections, large and small scale sections and details, isometrics, diagrams, schedules, tables and/or pictures.

**DSBSD:** Virginia Department of Small Business and Supplier Diversity.

**Emergency:** Any unforeseen situation, combination of circumstances, or a resulting state that poses imminent danger to health, life or property.

**Field Order:** A written order issued by the A/E which clarifies or explains the Plans or Specifications, or any portion or detail thereof, without changing the design, the Contract Price, the Time for Completion or the Contract Completion Date.

**Final Completion:** Completion and full performance of all Work in accordance with the terms and requirements of the Contract Documents, including the completion of all items identified on punch lists generated through the inspections set forth in Section 44(b) and submission of all information, manuals, warranties and documentation required by the Contract.

**Final Completion Date:** The date of the Owner's acceptance of the Work following Final Completion.

**Final Compliance Report:** A report where the Contractor shall certify and report on its compliance with the Small Business Procurement Plan, submitted by the Contractor in its Bid for the Contract, to the Owner through DGS' eVA system

**Final Payment:** The final payment that the Contractor receives pursuant to the applicable provisions of Section 36, except in the event no final payment is made due to termination of the Contract under either Sections 41 or 42. In the event of a termination for cause under Section 41, the Final Payment shall be when the termination became effective. In the event of a termination for convenience under Section 42, the Final Payment shall be either the payment of compensation for termination that the Contractor receives according to the provisions of Section 42(a), or the Owner's determination that no compensation for termination is due the Contractor under Section 42(a), as the case may be.

**Float:** The excess time included in a construction schedule to accommodate such items as inclement weather and associated delays, equipment failures, and other such unscheduled events. It is the contingency time associated with a path or chain of activities and represents the amount of time by which the early finish date of an activity may be delayed without impacting the Critical Path and delaying the Contract Completion Date. Any difference in time between the Contractor's approved early completion date and the Contract Completion Date shall be considered a part of the Float.

**Float, Free:** The time (in Days) by which an activity may be delayed or lengthened without impacting the start day of any successor activity.

**Float, Total:** The difference (in Days) between the maximum time available within which to perform an activity and the duration of an activity. It represents the time by which an activity may be delayed or lengthened without impacting the Contract Completion Date.

**General Conditions:** The General Conditions of the Construction Contract (CO-7 series).

**Limited Renovation:** Renovations that do not involve structural work (including, but not limited to, foundations, supports, beams, exterior roof supports, load bearing walls) and that do not involve Hot Work (as defined by the Virginia Statewide Fire Prevention Code) with the exception of brazing, soldering, and grinding.

**Major Renovation:** Renovations that do not meet the definition of Limited Renovation.

**Notice:** Notice required by the Contract shall be given in writing to the email address or physical delivery location identified in the Contract Documents for receipt of Notice by the receiving party. A Notice is deemed to have been properly given and effective at the time such Notice is: (i) deposited with a nationally recognized overnight delivery service using no more than two (2) business day delivery service for delivery to the Notice address; (ii) hand delivered to the Notice address; (iii) enclosed in a postage prepaid envelope addressed to the Notice address and delivered to a United States Postal Service for delivery by prepaid certified or registered mail; or (iv) sent via email to the email address identified for Notice in the Contract Documents.

**Notice to Proceed:** A written Notice given by the Owner to the Contractor fixing the date on which the Time for Completion will commence for the Contractor to begin the execution of the Work. The Notice to Proceed will identify the Contract Completion Date if not otherwise established by the Contract.

**Owner:** The public body with whom the Contractor has entered into the Contract for the Work. The term Owner shall also mean the Agency.

**Person:** This term includes any individual, corporation, partnership, association, company, business, trust, joint venture, or other legal entity.

**Plans:** The term used to describe the group or set of project-specific Drawings which are included in the Contract Documents.

**Prevailing Wage Rate:** Prevailing Wage Rate means that rate, amount, or level of wages, salaries, benefits and other remuneration prevailing for a classification of mechanics, laborers, or workers employed

for the same work in the same trade, craft or occupation in the locality of the Project as determined by the Commissioner of Labor and Industry.

**Project:** The term used instead of the specific or proper assigned title of the entire undertaking which includes, but is not limited to, the Work and the A/E Services.

**Project Inspector:** One or more persons employed by the Owner to inspect the Work for the Owner and/or to document and maintain records of activities at the Site to the extent required by the Owner. The scope of the Project Inspector's authority with respect to the Contractor is limited to that indicated in Section 16 (e) and (f) of the General Conditions and as supplemented by the Owner in writing to the Project Inspector and to the Contractor.

**Project Manager:** The Project Manager shall be the Owner's designated representative on the Project. The Project Manager shall be the person through whom the Owner generally conveys written decisions and instructions. All Notices to the Owner and all information required to be conveyed to the Owner shall be conveyed to the Project Manager unless otherwise stated in the Contract. The scope of the Project Manager's authority is limited to that authorized by the Owner. The Owner may change the Project Manager from time to time and may, in the event that the Project Manager is absent, disabled or otherwise temporarily unable to fulfill their duties, appoint an interim Project Manager.

**Provide:** Shall mean furnish and install ready for its intended use.

**Record Drawings:** Record Drawings are a final compilation set of drawings showing the "as built" condition of the Work, including all conditions, locations and dimensions based on the Contractor's As-Built Drawings. The Record Drawings shall contain the Plans, Specification, Addenda, approved shop drawings, and any other information needed to show the final condition of the work, actual location of piping and utilities, the depths of pilings or caissons if pilings or caissons were in the construction, and the integration of all Change Orders to the Work.

**Recycled:** Equipment, materials, and accessories which have been previously used and that have been processed to form a new product deemed an equal per Section 26.b.

**Service Disabled Veteran-Owned Business:** A business that meets the definition of "Service disabled veteran business" as set forth in *Code of Virginia*, § 2.2-4310.

**Schedule of Values:** That portion of Form CO-12 prepared by the Contractor and acceptable to the Owner which indicates the portion of the Contract Price to be paid for each trade or major component of the Work.

**Shop Drawings:** The drawings, diagrams, illustrations, schedules, installation descriptions and other data prepared by or for the Contractor to provide detailed information for the fabrication, location, erection, installation, connection and methodology associated with the Work. Shop Drawings are intended to aid in the preparation and installation of materials and to ascertain that the materials proposed by the Contractor conform to the requirements of the Contract Documents.

**Site:** The location at which the Work is performed or is to be performed.

**Small Business:** A business certified as a small business by the DSBSD.

**Small Business Procurement Plan:** The proposed type and percentage of small business participation in the Total Base Bid Amount submitted by the Contractor as part of its Bid.

**Special Conditions:** That part of the Contract Documents which describes special or additional requirements or procedures applicable to the Project. The Special Conditions do not amend or supersede the General Conditions.

**Specifications:** That part of the Contract Documents containing the written administrative requirements and the technical descriptions of materials, equipment, construction systems, standards, and workmanship for the Work.

**Subcontractor:** A person or firm having a direct contract with Contractor or with any other Subcontractor for the performance of the Work. Subcontractor includes any person or firm who provides on-Site labor but does not include a Supplier.

**Submittals:** All Shop, fabrication, setting and installation drawings, diagrams, illustrations, schedules, samples, and other data required by the Contract Documents which are specifically prepared by or for the Contractor to illustrate some portion of the Work and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a Supplier and submitted by the Contractor to illustrate material or equipment conformance of some portion of the Work with the requirements of the Contract Documents. Submittal as used herein includes Shop Drawings.

**Substantial Completion:** The stage in the progress of the Work at which the Owner agrees that the Work or a specific portion thereof, is sufficiently complete, in accordance with the Contract Documents, so that it can be utilized by the Owner for the purposes for which it was intended. The Owner at its sole discretion may, after obtaining the necessary approvals and certificates, take Beneficial Occupancy at this time or choose to wait to occupy until after Final Completion is achieved.

**Supplemental General Conditions:** An amendment or modification which amends or supplements the General Conditions.

**Supplier:** A manufacturer, fabricator, distributor, supplier or vendor who provides material or equipment for the Project but does not provide on-Site labor.

**SWaM/SDV Business:** All subcategories of Small Businesses certified by the DSBSD including Micro Business, Minority-Owned Business, Service-Disabled Veteran-Owned Business, Small Business, and/or Women-Owned Business together as a group.

**Time for Completion:** The number of consecutive Days following the Date of Commencement within which the Contractor must achieve Substantial Completion of the Work in accordance with the Contract Documents.

**Total Contract Amount:** The total compensation payable to the Contractor for performing the Contract, subject to modification by Change Order.

**Underground Facilities:** All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which are or have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems or water.

**Work:** The construction and services required by the Contract Documents, whether completed or partially completed, including, but not limited to, furnishing labor, furnishing and incorporating materials and equipment into the Construction. The Work includes the entire completed Construction, or the various separately identifiable parts thereof, required to be provided under the Contract Documents or which may reasonably be expected to be provided as part of a complete, code compliant and functioning system for those systems depicted in the Plans and Specifications.

## 2. CONTRACT DOCUMENTS

The Contract Documents consist of the Contract and all other documents identified therein as Contract Documents as more precisely defined above.

### 3. LAWS AND REGULATIONS

- a. The Contractor shall comply with the Virginia Uniform Statewide Building Code and all laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the performance of the Work and shall give all notices required thereby. The Contractor shall assure that all Subcontractors and tradespeople who perform Work on the Project are properly licensed by the Department of Professional and Occupational Regulation as required by Title 54.1, Chapter 11, and Article 1 of the *Code of Virginia* and by applicable regulations.
- b. This Contract and all other contracts and Subcontracts are subject to the provisions of Article 3, Chapter 4, Title 40.1, *Code of Virginia*, relating to labor unions and the “right to work.” The Contractor and its Subcontractors, whether residents or nonresidents of the Commonwealth, who perform any Work related to the Project shall comply with all of the said provisions.
- c. IMMIGRATION REFORM AND CONTROL ACT OF 1986: By signing this Contract, the Contractor certifies that it does not and shall not during the performance of this Contract knowingly employ an unauthorized alien as defined in the Federal Immigration Reform and Control Act of 1986, or otherwise violate its provisions.
- d. E-VERIFY PROGRAM: Pursuant to *Code of Virginia*, § 2.2-4308.2, any employer with more than an average of 50 employees for the previous 12 months entering into a contract in excess of \$50,000 with any agency of the Commonwealth to perform work or provide services pursuant to such contract shall register and participate in the E-Verify program to verify information and work authorization of its newly hired employees performing work pursuant to such public contract. Any such employer who fails to comply with these provisions may be debarred from contracting with any agency of the Commonwealth for a period up to one year. Such debarment may cease upon the employer’s registration and participation in the E-Verify program. If requested, the employer shall present a copy of their Maintain Company page from E-Verify to prove that they are enrolled in E-Verify.
- e. In performing the Work under this Contract, the Contractor shall comply with the provisions of all rules and regulations governing safety as adopted by the Safety Codes Commission of the Commonwealth of Virginia and as issued by the Department of Labor and Industry under Title 40.1 of the *Code of Virginia*. Inspectors from the Department of Labor and Industry shall be granted access to the Work for inspection without first obtaining a search or administrative warrant.
- f. Building Permit: Because this Project is on Commonwealth of Virginia property, codes or zoning ordinances of local political subdivisions do not apply to Work at the Site. The Virginia Uniform Statewide Building Code applies to the Work and is administered by the Building Official for State-owned buildings and real property. The Building Permit will be obtained and paid for by the Owner. All other permits, local license fees, business fees, taxes, or similar assessments imposed by the appropriate political subdivision and the Department of Environmental Quality shall be obtained and paid for by the Contractor. See Section 25 of these General Conditions for utility connection fees and services.
- g. The Contractor shall include in each of its Subcontracts a provision requiring each Subcontractor to include or otherwise be subject to the same payment and interest requirements in Subsections (a), (b), and (c) of Section 37 of these General Conditions with respect to each lower-tier Subcontractor and Supplier.
- h. The Contractor, if not licensed as an asbestos abatement contractor in accordance with *Code of Virginia*, § 54.1-514, shall have all asbestos-related Work performed by Subcontractors who are duly licensed as asbestos contractors for the Work required.

- i. Lead-Based Paint Activities: If the Contract Documents indicate that lead-based paint is present on existing materials, components, or surfaces, the Contractor shall conform to the following:
  - 1. The requirements set forth in 40 CFR 745.233 – Lead-Based Paint Activities Requirements in selecting and performing the means, methods and procedures for performing the Work. This includes, but is not limited to, training of personnel, lead abatement, encapsulation of lead-containing materials, removal and handling of lead-containing materials, and methods of disposal.
  - 2. The requirements for employee protection contained in 29 CFR Part 1926, Subpart D, and the requirements for record-keeping contained 29 CFR Part 1910.
  - 3. The Virginia Department of Labor and Industry’s (DLI) Regulation Concerning Certified Lead Contractors Notification, Lead Project Permits and Permit Fees published in the Virginia Administrative Code, 16 VAC25-35, requiring, among other things, that a permit be issued to the lead abatement contractor, or any subsequent regulation issued by DLI pertaining to lead-based paint abatement.
- j. If the Contractor violates laws or regulations that govern the Project, the Contractor shall take prompt action to correct or abate such violation and shall indemnify and hold the Owner harmless against any fines and/or penalties that result from such violation. The Contractor also shall indemnify and hold the Owner harmless against any third-party claims, suits, awards, actions, causes of action or judgments, including but not limited to attorney’s fees and costs incurred thereunder, that arise or result from Contractor’s violation of laws or regulations.
- k. If the Work includes any land-disturbing activities, the Contractor shall have on-Site an individual certified by the Department of Environmental Quality as a Responsible Land Disturber in accordance with *Code of Virginia*, § 62.1-44.15:51.
- l. Unless otherwise specified in the Supplemental General Conditions, the Contractor is neither required nor prohibited from entering into or adhering to agreements with one or more labor organizations, or otherwise discriminating against Subcontractors for becoming or refusing to become, or remaining signatories to or otherwise adhering to, agreements with one or more labor organizations. This section does not prohibit Contractor or Subcontractors from voluntarily entering into agreements with one or more labor organizations. Both the Agency and Contractor are entitled to injunctive relief to prevent any violation of this section.

This section does not apply to any public-private agreement for any construction in which the private body, as a condition of its investment or partnership with the state agency, requires that the private body have the right to control its labor relations policy and perform all work associated with such investment or partnership in compliance with all collective bargaining agreements to which the private party is a signatory and is thus legally bound with its own employees and the employees of its contractors and subcontractors in any manner permitted by the National Labor Relations Act, 29 U.S.C. § 151 *et seq.*, or the Railway Labor Act, 45 U.S.C. § 151 *et seq.*

This section does not prohibit an employer or any other person covered by the National Labor Relations Act or the Railway Labor Act from entering into agreements or engaging in any other activity protected by law.

This section shall not be interpreted to interfere with the labor relations of persons covered by the National Labor Relations Act or the Railway Labor Act.

- m. Payment of Prevailing Wages Pursuant to Virginia Code 2.2-4321.3

*Code of Virginia* § 2.2-4321.3 and the following requirements shall be applicable to the Work of the Contract if the Contract Price is greater than \$250,000.00:

1. The Contractor agrees that all remuneration to any individual providing labor for the Project or the Work as a mechanic, laborer, worker or equivalent shall be paid at a rate not less than the Prevailing Wage Rate beginning upon the individual's first day of work at or for the Project.
  2. Upon award of the Contract, the Contractor shall certify, under oath, to the Commissioner of Labor and Industry the pay scale for each craft and trade to be employed for, or to provide labor for, the Project or the Work by the Contractor and any Subcontractors. The Contractor's certification shall include all information required by *Code of Virginia* § 2.2-4321.3(G). The Contractor shall provide a copy of this certification to the Owner at the time it is provided to the Commissioner of Labor and Industry.
  3. The Contractor shall ensure that each individual providing labor as a mechanic, laborer, worker or equivalent shall be accurately classified in conformance with the Prevailing Wage Rate determinations.
  4. The Contractor and all Subcontractors shall keep, maintain, and preserve all records relating to the occupation, work classification, wages paid to and hours worked for each individual providing labor for the Project or the Work as a mechanic, laborer, worker or equivalent in a manner which complies with the requirements of *Code of Virginia* § 2.2-4321.3(H). The Contractor and all Subcontractors shall retain these and any other required payroll records for the period required by *Code of Virginia* § 2.2-4321.3(H). The Contractor and its Subcontractors shall make available to the Owner all records required by *Code of Virginia* § 2.2-4321.3(H) for inspection and copying within five (5) days of Owner's request.
  5. The Contractor and all Subcontractors shall post all Prevailing Wage Rates applicable to the Project and the Work in a prominent and easily accessible place at the Site. The Contractor and all Subcontractors shall timely make all postings, updates to postings, and certification required by *Code of Virginia* § 2.2-4321.3(I). The Contractor shall provide the Owner with a copy of each certification made to the Commissioner of Labor and Industry pursuant to *Code of Virginia* § 2.2-4321.3(I) at the time the certification is provided to the Commissioner of Labor and Industry.
  6. The Contractor shall indemnify and hold harmless the Owner from any fines, demands, claims, suits and damages, including any attorney's fees incurred by the Owner, resulting from or relating to the Contractor's or any Subcontractor's failure to pay the Prevailing Wage to a mechanic, laborer, worker or equivalent individual or to comply with the requirements of *Code of Virginia* § 2.2-4321.3.
- n. *Code of Virginia*, § 2.2-4376.2 shall be applicable to the Work of the Contract.

#### 4. NONDISCRIMINATION

- a. Contractor shall comply with the Federal Civil Rights Act of 1964, as amended, the Virginia Fair Employment Contracting Act of 1975, as amended, the Virginia Human Rights Act, as amended, and the laws of the Commonwealth of Virginia and all Executive Orders in effect at the time of the Work which safeguard individuals from unlawful discrimination in employment.
- b. *Code of Virginia* § 2.2-4311 and executive orders currently in effect shall be applicable to the Work of the Contract. During the performance of this Contract, the Contractor agrees as follows:

1. The Contractor shall not discriminate against any employee or applicant for employment, subcontracting, and delivery of goods and services because of race, religion, color, sex, national origin, age, disability, or other basis prohibited by state law or executive order relating to discrimination in employment, except where there is a bona fide occupational qualification reasonably necessary to the normal operation of the contractor. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.
  2. The Contractor, in all solicitations or advertisements for employees placed by or on behalf of the contractor, will state that such Contractor is an equal opportunity employer.
  3. Notices, advertisements and solicitations placed in accordance with federal law, rule or regulation shall be deemed sufficient for the purpose of meeting the requirements of this section.
  4. The Contractor shall include the provisions of the foregoing subparagraphs 1, 2 and 3 in every Subcontract or purchase order over \$10,000, so that the provisions will be binding upon each Subcontractor and Supplier.
- c. *Code of Virginia*, § 2.2-4201 shall be applicable to the Work of the Contract. During the performance of this Contract, the Contractor agrees as follows:
1. The Contractor shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, or national origin, except where religion, sex or national origin is a bona fide occupational qualification reasonably necessary to the normal operation of the Contractor. The Contractor shall post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause, including the names of all contracting agencies with which the Contractor has contracts over \$10,000.
  2. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that Contractor is an equal opportunity employer. However, notices, advertisements and solicitations placed in accordance with federal law, rule or regulation shall be deemed sufficient for the purpose of meeting the requirements of this chapter
  3. If the Contractor employs more than five (5) employees, the Contractor shall: (i) provide annual training on the Contractor's sexual harassment policy to all Contractor's supervisors and employees providing services in the Commonwealth of Virginia, except such supervisors or employees who are required to complete sexual harassment training provided by the Commonwealth of Virginia Department of Human Resource Management; and (ii) post the Contractor's sexual harassment policy in: (a) a conspicuous public place in each building located in the Commonwealth that the Contractor owns or leases for business purposes; and (b) the Contractor's employee handbook.
  4. The Contractor shall include the provisions of the foregoing subparagraph 1, 2 and 3 in every Subcontract and purchase order over \$10,000, so that the provisions will be binding upon each Subcontractor and Supplier.
- d. Where applicable, the Virginians with Disabilities Act and the federal Americans with Disabilities Act shall apply to the Contractor and all Subcontractors and Suppliers.
- e. The Owner does not discriminate against faith-based organizations as defined in *Code of Virginia* § 2.2-4343.1(B).

**5. PROHIBITION OF ALCOHOL AND OTHER DRUGS**

- a. The Contractor shall establish a written policy to maintain and enforce a drug-free workplace, to specify actions that will be taken against persons for violations of the policy, and to require that such policy be binding on each of its employees, Subcontractors, and Suppliers performing Work of the Contract.
- b. The Contractor's policy shall prohibit the following acts by all Contractor, Subcontractor, and Supplier personnel at the Site:
  - 1. The manufacture, distribution, dispensation, possession, or use of a controlled substance or marijuana, except possession and medically prescribed use of prescription drugs; and
  - 2. The impairment of judgment or physical abilities due to the use of a controlled substance or marijuana, including impairment from prescription drugs.
- c. The Contractor shall post a copy of this policy in a conspicuous place at the Site and assure that all personnel, including potential hires, are advised of the policy. A violation of this policy will be recognized as a breach of Contract and may result in termination of the Contract.
- d. The Contractor shall include in all solicitations or advertisements for employees placed by or on behalf of the Contractor that the Contractor maintains a drug-free workplace.
- e. The Contractor shall include the foregoing provisions as binding upon each Subcontractor and Supplier in every subcontract or purchase order over \$10,000.
- f. For the purposes of this section, "drug-free workplace" means a site for the performance of work done in connection with a specific contract awarded to a contractor in accordance with this chapter, the employees of whom are prohibited from engaging in the unlawful manufacture, sale, distribution, dispensation, possession or use of any controlled substance or marijuana during the performance of the contract.

**6. TIME FOR COMPLETION**

- a. The Contractor shall achieve Substantial Completion on or before the Contract Completion Date. Unless otherwise specified, the Contractor shall achieve Final Completion within thirty (30) Days after the Contract Completion Date.
- b. The Contractor acknowledges and agrees that the Owner is relying upon the Time for Completion and Contract Completion Date for planning the use and Beneficial Occupancy of the Work and for all other purposes. If the Contractor fails to achieve Substantial Completion by the Contract Completion Date, the Contractor shall be subject to payment of actual damages incurred by the Owner or liquidated damages, if provided for in the Contract.
- c. The Contractor, in submitting its bid or proposal, acknowledges that the Time for Completion is a reasonable duration and period for performing the Work and that it has taken into consideration normal weather conditions for the period of performance. Normal weather does not mean statistically average weather, but rather means a range of weather patterns which might be anticipated based on weather conditions and events for the past ten (10) years. Normal weather conditions shall be determined from the public historical records available, including the U.S. Department of Commerce, Local Climatological Data Sheets, National Oceanic and Atmospheric Administration / Environmental Data and Information Service, National Climatic Center and National Weather Service. The data sheets to be used shall be those for the locality or localities closest to the Site. No additional compensation, costs or damages will be paid to the Contractor

because of normal weather conditions, including normal adverse weather to be anticipated during the Project. An extension of time for abnormal adverse weather conditions which directly impact the Work will be considered by the Owner upon under the following conditions, all of which must be strictly complied with and demonstrated by the Contractor:

1. A request for extension of time-based on abnormal adverse weather conditions must be made in writing within fourteen (14) Days of the completion of the calendar month during which the abnormal adverse weather conditions impacted the Work at the Site. The request for additional time shall be substantiated by weather data collected during the period of delay at the Site. Said data must demonstrate an actual departure from weather conditions that could have been anticipated at the Site during the dates in question.
2. The abnormal adverse weather must have caused a delay to the Contract Completion Date as a result of a delay to the Critical Path as depicted on the accepted "critical path method" schedule or the approved bar graph schedule current at the time of the weather event. No extension will be considered for any portion of any delay which consumes only Float.
3. All of the evidence and data supporting the request (including both historical data and the recordings at the Site during the time of delay) must be furnished to the Owner before the end of the calendar month following the month for which the request is made.

Compliance with the requirements of this section is a condition precedent to the Contractor's entitlement to any change or adjustment to the Contract Completion Date for impacts from abnormal weather conditions.

- d. The Contractor's execution of the Contract is a representation and agreement that the Contractor has visited the Site and reviewed the requirements of the bid documents, the Contract Documents, local conditions, availability of materials, equipment, and labor, the reasonable time required for the Owner to respond to Submittals, and any other factors which may affect the performance of the Work, and has taken all these factors into consideration in submitting its bid and executing this Contract.

## **7. CONDITIONS AT SITE**

- a. The Contractor shall have visited the Site prior to bidding or submitting its proposal and is totally responsible for having ascertained pertinent local conditions such as location, accessibility and general character of the Site, and the character and extent of existing conditions, improvements and work within or adjacent to the Site. The Contractor shall not submit any claims or any request for adjustments of the Contract Price or Contract Completion Date which result from its failure to consider such conditions.
- b. If in the performance of the Work the Contractor encounters (i) hidden physical conditions of a building being modified which are materially different from those ordinarily encountered or generally recognized as inherent in the activities being performed or (ii) subsurface or concealed latent conditions which are materially different from those frequently present in the locality or from those indicated in the Contract Documents, the Contractor shall promptly provide Notice to the Owner and A/E before the conditions are disturbed and not later than seven (7) Days after discovery. The A/E shall promptly review the conditions and propose such changes or adjustments, if any, in the Contract Documents that may be necessary to address the conditions. The Contractor must request any change in the Contract Price or Contract Completion Date for such conditions pursuant to the applicable requirements in Sections 38, 39, and 43 of these General Conditions. Compliance with the requirements of this section is a condition precedent to the Contractor's entitlement to any change or adjustment in the Contract Price or Contract Completion Date as a result of such Site conditions.

- c. If the Contractor, during the course of the Work, observes the existence of any material which he knows, should know, or has reason to believe is hazardous to human health, the Contractor shall promptly notify the Owner in writing before the material is disturbed further or the affected work is performed. The Owner will provide the Contractor with instructions regarding the disposition of the material. The Contractor shall not perform any Work involving the material or any Work causing the material to be less accessible prior to receipt of special instructions from the Owner. The Contractor must request any change in the Contract Price or Contract Completion Date for such conditions pursuant to the applicable requirements in Sections 38, 39 and 43 of these General Conditions. Compliance with the requirements of this section is a condition precedent to the Contractor's entitlement to any change or adjustment in the Contract Price or Contract Completion Date as a result of such Site conditions.

## 8. CONTRACT SECURITY

- a. For contracts with a value exceeding Five Hundred Thousand Dollars (\$500,000) or as required by the Owner on the CO-9, the Contractor shall deliver to the Owner or its designated representative, a Commonwealth of Virginia Standard Performance Bond, DGS-30-084 (CO-10) and a Commonwealth of Virginia Standard Labor and Material Payment Bond, DGS-30-088 (CO-10.1), each fully executed by the Contractor and one or more surety companies legally licensed to do business in Virginia and each in an amount equal to one hundred percent (100%) of the Contract Price. If more than one Surety executes a bond, each shall be jointly and severally liable to the Owner for the entire amount of the bond. Sureties shall be selected by the Contractor, subject to approval by the Owner. No payment on the Contract shall be due and payable to the Contractor until the bonds have been approved by the Owner and the Office of the Attorney General of Virginia. To facilitate review of the bonds by the Office of the Attorney General, the power of attorney from the surety company to its agent who executes the bond shall be attached to the bond, or, if not so attached, prior to the execution of the bonds by the surety, recorded in the Office of the Clerk of Court for the City of Richmond, Virginia, at the John Marshall Court Building, 400 North Ninth Street, Richmond, VA 23219.
- b. For the purposes of all Standard Labor and Material Payment Bonds entered into, the term "subcontractors" as used in § 2.2-4337(A)(2) of the *Code of Virginia* is interpreted to mean any Subcontractors at any tier who participated in the prosecution of the Work undertaken by the Contractor (referred to in § 2.2-4337(A)(2) of the *Code of Virginia* as the "prime contractor"), whether such Subcontractor had a direct contract with the Contractor (prime contractor) or another Subcontractor, regardless of whether there were one or more other intervening Subcontractors contractually positioned between it and the Contractor (prime contractor).
- c. *Code of Virginia* § 2.2-4338 allows for alternative forms of security in lieu of payment and/or performance bonds. No alternative forms of security shall be allowed unless approved in writing by Owner prior to Contractor's submission of its Bid or proposal.
- d. Mechanic's liens may not be filed or recorded on Owner, Agency, or Commonwealth property. The Contractor shall keep the Owner's property free and clear from all mechanic's liens. The Contractor shall, upon Notice from the Owner, cause any liens filed or recorded to be released within ten (10) Days from Notice at its cost and expense; and if the Contractor fails to do so, the Owner shall have the right, but not the obligation, to cause such lien to be released by bonding or otherwise, and the Contractor shall indemnify and hold harmless the Owner from all costs and expenses incurred or to be incurred as a result, including bond premiums, court costs and attorneys' fees arising from or related to such liens. At the Owner's option, it may withhold payment of any sums due the Contractor until any such liens are released, and may deduct such costs or expenses from any payment then due or thereafter becoming due from the Owner to the Contractor.

## 9. SUBCONTRACTS

- a. The Contractor shall, as soon as practicable after the signing of the Contract, notify the Owner and A/E in writing of the names of all Subcontractors proposed for the principal parts of the Work and of such others as the A/E may direct. Where the Specifications establish qualifications or criteria for Subcontractors, manufacturers, or individuals performing Work on the Project, the Contractor shall be responsible for ascertaining that those proposed meet the criteria or qualifications. The Contractor shall not employ any Subcontractor that the Owner may, within a reasonable time, object to as unsuitable. Neither the Owner nor the A/E shall direct the Contractor to contract with any particular Subcontractor unless provided in the Specifications or Invitation for Bids.
- b. The Owner may select a particular Subcontractor for a certain part of the Work and designate on the Invitation for Bids or Request for Proposal that the Subcontractor shall be used for the part of the Work indicated and that the Subcontractor has agreed to perform the Work for the subcontract amount stipulated on the bid or Proposal form. The Contractor shall include the stipulated amount plus its markups in the bid or Proposal. In such case, the Contractor shall be responsible for that Subcontractor and its work and the Subcontractor shall be responsible to the Contractor for its work just as if the Contractor had selected the Subcontractor. If the Contractor has a reasonable objection to the Subcontractor designated, then the Contractor shall note the exception in its bid or proposal and the reason for the exception and maintain appropriate provisions for coordinating the work of the Subcontractor. The Owner, at its sole discretion, may accept the Contractor's bid or proposal with the exception noted and contract separately with the Subcontractor under the provisions of Section 10 of the Contract or designate a different Subcontractor.
- c. The Owner shall, on request, furnish to any Subcontractor, if practicable, the amounts of payments made to the Contractor, the Schedule of Values and Requests for Payment submitted by the Contractor, and any other documentation submitted by the Contractor which would tend to show what amounts are due and payable by the Contractor to the Subcontractor.
- d. The Contractor shall be fully responsible to the Owner for all acts and omissions of its agents and employees and all tiers of Subcontractors and Suppliers performing or furnishing any of the Work. Nothing in the Contract Documents shall create any contractual relationship between Owner or A/E and any Subcontractor, Supplier or other Person, nor shall it create any obligation on the part of Owner or A/E to pay for or to see to the payment of any moneys due any Subcontractor, Supplier or other Person, except as may otherwise be required by law.
- e. The Contractor shall be fully responsible for its invitees at the Site and for those of its Subcontractors, Suppliers, and their employees, including any acts or omissions of such invitees.
- f. The Contractor agrees that it is responsible for all dealings and coordination with Subcontractors and Suppliers, and their subcontractors, employees and invitees, including, but not limited to, the Subcontractors' or Suppliers' claims, demands, actions, disputes and similar matters unless specifically provided otherwise by the Contract or by statute.

## 10. SEPARATE CONTRACTS

- a. The Owner reserves the right to let other contracts in connection with the Project, the work under which may proceed simultaneously with the execution of this Contract. The Contractor shall afford separate contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work. The Contractor shall cooperate with them and shall take all reasonable action to coordinate its Work with that of separate contractors. If the Owner has listed other separate contracts in the Invitation for Bids or Requests for Proposal which it expects to proceed simultaneously with the Work of the Contractor, and has included the estimated timing of such other contracts in the Invitation for Bids or Requests for Proposal, the Contractor shall integrate the schedule of those separate contracts into its scheduling. The Contractor shall make

every reasonable effort to assist the Owner in maintaining the schedules for all separate contracts. If the work performed by a separate contractor is Defective or performed so as to prevent or threaten to prevent the Contractor from carrying out its Work according to the Contract, the Contractor shall immediately notify the Owner and the A/E upon discovering such conditions.

- b. If a dispute arises between the Contractor and any separate contractor(s) as to their responsibility for cleaning up the Site, the Owner may clean up and charge the cost thereof to the respective contractors in proportion to their responsibility. If the Contractor disputes the Owner's apportionment of clean-up costs, it shall be the Contractor's burden to demonstrate and prove the correct apportionment.

## 11. CONTRACTOR'S AND SUBCONTRACTOR'S INSURANCE

- a. The Contractor shall not commence Work under this Contract until all insurance required hereunder has been obtained from an insurer authorized to do business in Virginia and such insurance has been approved by the Owner. The Contractor shall provide to the Owner Certificates of Insurance for all required coverage and, upon request, shall provide full copies of the Contractor's insurance policies. Approval of insurance by the Owner shall not relieve or decrease the liability of the Contractor hereunder.
- b. The Contractor shall procure and maintain, as required herein, the following insurance coverages:
  - 1. Workers' Compensation and Employer's Liability Insurance to cover all employees engaged in the Work of a type and in an amount to meet all Commonwealth of Virginia statutory requirements and regulations to provide all benefits to which employees may be entitled, including Employers Liability, with limits no less than \$1,000,000 bodily injury by accident or disease, each employee. Where applicable, coverage shall be extended to cover any claims under the United States Longshoreman's Act and Harbor Workers Act and Jones Act as may be appropriate for the work.
  - 2. Comprehensive General Liability insurance, including coverage for Broad Form Contractual, Premises/Operations, Product and Completed Operations, Independent Contractor's Liability, and Personal Injury Liability, with limits of at least \$2,000,000 per occurrence and \$2,000,000 aggregate, applicable on a per-project basis. The policy shall not exclude or limit the amount of coverage for the Work of the Project or for explosion, collapse, underground operations, mold, or exterior insulation and finish system ("EIFS").
  - 3. Automobile Liability Insurance with a limit of not less than \$1 million combined single limit for bodily injury and property damage per occurrence, covering all owned, non-owned, hired and borrowed vehicles, whether on-Site or off-Site.
  - 4. Contractor or the Asbestos Subcontractor shall provide occurrence-based liability insurance with asbestos coverages in an amount not less than \$1,000,000. The following shall be named as additional insureds on this policy: the Commonwealth of Virginia, its officers, employees and agents; the A/E (if not the Asbestos Project Designer); and the Contractor (where the asbestos work is being performed by the Asbestos Subcontractor).
- c. Unless otherwise specified, Contractor shall ensure that all insurance required by Subsection (b) above contains the following provisions:
  - 1. With the exception of Workers' Compensation insurance, the Commonwealth of Virginia, the Owner, and their officers, employees and agents shall be named as additional insureds on all policies. The additional insureds as stated for the asbestos coverage shall be as stated in Section 11(b)(4).
  - 2. All insurance coverage shall be considered primary and non-contributory with respect to

other insurance that might be available to the Contractor, A/E, Owner, or Agency.

3. All insurers shall waive rights of subrogation against the Commonwealth of Virginia, Owner and Agency for any claims covered by the insurance required herein.
4. All deductibles or self-insured retentions shall be the sole responsibility of the Contractor.
- d. No insurance will be canceled, dropped, replaced, or materially changed without at least thirty (30) Days' prior written Notice to and consent of the Owner.
- e. Contractor shall require each Subcontractor to carry the same insurance, and in the same amounts, required by Section 11(b)(1)-(3) above. The Contractor shall not allow any Subcontractor to commence Work on the Project until all insurance required of the Subcontractor by this Contract has been obtained by the Subcontractor and approved by the Contractor.
- f. Prior to award of the Contract, the Contractor shall submit, on the form provided by the Owner, a Certificate of Coverage verifying Workers' Compensation insurance is in place. The Contractor shall likewise obtain a Certificate of Coverage for Workers' Compensation insurance from each Subcontractor and shall provide a copy to the Owner prior to the Subcontractor beginning Work at the Project.

**12. "ALL-RISK" BUILDER'S RISK INSURANCE TO INCLUDE AN INSTALLATION FLOATER**

- a. The Contractor shall procure and maintain, at its cost, "all-risk" Builder's Risk insurance with minimum coverage and limits as follows:
  1. **New Construction, Addition, or Major Renovation:** When the Work is new construction, addition, or Major Renovation, the Contractor shall maintain "all-risk" Builder's Risk insurance for the Work and the entire structure or structures, if any, on which the Work is to be done with a minimum limit of not less than the insurable value of the structure(s) plus one hundred percent (100%) of the Contract Price and the value of all Change Orders, to represent the total value of the structure(s) and the Work on a replacement cost basis.
  2. **Limited Renovation:** When the Work is Limited Renovation to an existing structure, the Contractor shall maintain "all risk" Builder's Risk insurance in an amount equal to one hundred percent (100%) of the Contract Price and the value of all Change Orders, to represent the total value of the Work on a replacement cost basis. .

When a project is an addition with Limited Renovation to an existing structure, then the insurable value of the existing structure shall not be included.

- b. Builder's risk insurance shall be provided on an "all risk" or equivalent policy form and shall include, without limitation, insurance against all perils. The insurance shall cover the costs of debris removal, temporary buildings, legal requirements, and compensation for A/E services and Contractor services required following an insured loss. The insurance shall cover portions of the Work stored off-Site, Work in transit, and all materials, supplies, equipment, machinery, and fixtures that are or will be part of the Project. The policy shall include coverage for mold resulting from a covered peril, property in transit or temporary storage, equipment breakdown/course of construction, and soft costs within the aggregate or blanket limit of the of the policy. If not otherwise covered by the Builder's Risk policy, Contractor also shall provide an installation floater to cover all equipment and materials intended for installation at the Project.

In the event the policy includes any coverages where the limit is less than the aggregate or blanket limit of the policy (sub limits), the coverage shall be no less than the stated minimum sub-limits for the following perils:

- Flood	\$2,000,000
- Earth Movement	\$2,000,000
- Debris Removal	\$2,000,000
- Extra or Expediting Expense	\$250,000
- Interior Water Damage	\$2,000,000
- Loss of Income/Extra Expense	12 Months
- Soft Costs	Blanket or Aggregate Limit/14 Day Waiting Period

The Certificate of Insurance provided to the Owner shall disclose all sub-limits, stating the peril and limit applying to each. In the event that the aggregate policy limit is less than the sub-limits identified above, coverage for all perils must be provided within the aggregate or blanket limit of the policy.

- c. Builder's risk insurance may include a deductible provision if the Owner so provides in the Supplemental General Conditions, in which case the Contractor will be liable for such deductible whenever a claim arises. Any loss payable under the Builder's Risk insurance shall be payable to the Owner, in accordance with its interests, as they may appear, and then to any other persons insured thereunder.

Written evidence of this insurance and a copy of the policy shall be provided to the Owner no later than thirty (30) Days following the award of the Contract. The policy shall not be canceled, dropped, replaced, or materially changed without at least thirty (30) Days' prior written Notice to and consent of the Owner.

- d. Builder's risk insurance shall include the interest of the Contractor, the Owner, the Commonwealth, and all Subcontractors and Sub-subcontractors. Contractor shall maintain the builder's risk insurance until Final Payment by the Owner or until no person other than the Owner has an insurable interest in the Work, whichever is later.
- e. Any insurance provided through the Department of Treasury, Division of Risk Management, on buildings, construction, additions or renovations will not extend to Contractor's nor Subcontractors' buildings, equipment, materials, tools or supplies unless these items are to become property of the Owner upon completion of the Project and the Owner has assumed responsibility for such items at the time of the loss.

### 13. TAXES, FEES AND ASSESSMENTS

The Contractor shall, without additional expense to the Owner, pay all applicable federal, state, and local taxes, fees, and assessments arising out of the Work, except the taxes, fees and assessments on the real property comprising the Site. If the State Building Official elects to have the local building official inspect the Work as provided by *Code of Virginia* § 36-98.1, the Owner shall pay the resulting fees to the local building official.

#### 14. PATENTS

The Contractor shall obtain all licenses necessary to use any invention, article, appliance, process or technique of whatever kind and shall pay all royalties and license fees. The Contractor shall indemnify and hold harmless the Owner, its officers, agents and employees, against any loss or liability for or on account of the infringement of any patent rights in connection with any invention, process, technique, article or appliance manufactured or used in the performance of the Contract, including its use by the Owner, unless such invention, process, technique, article or appliance is specifically named in the Specifications or Plans as acceptable for use in carrying out the Work. If, before using any invention, process, technique, article or appliance specifically named in the Specifications or Plans as acceptable for use in carrying out the Work, the Contractor has or acquires information that the same is covered by letters of patent making it necessary to secure the permission of the patentee, or other, for the use of the same, the Contractor shall promptly advise the Owner and the A/E. The Owner may direct that some other invention, process, technique, article or appliance be used. Should the Contractor have reason to believe that the invention, process, technique, article or appliance so specified is an infringement of a patent, and fails to inform the Owner and the A/E, the Contractor shall be responsible for any loss or liability due to the infringement.

#### 15. ARCHITECT/ENGINEER'S STATUS

- a. The A/E shall have authority to endeavor to secure the faithful performance of the Work by Contractor. The A/E shall review the Contractor's Submittals for conformance to the requirements of the Contract Documents and return copies to the Contractor with appropriate notations. The A/E shall interpret the requirements of the Plans and Specifications and issue Field Orders to the Contractor as may be required. The A/E shall recommend to the Owner suspension of the Work (in whole or in part) whenever such suspension may be necessary to ensure the proper execution of the Work or the requirements of the Contract. The A/E shall have authority to reject, in writing, Work, including material, installation or workmanship, which does not conform to the Contract Documents or is Defective. The A/E shall determine the progress and quality of the Work, subject to the right of the Owner to make an overriding decision to the contrary. Upon request by the Contractor, the A/E shall confirm, in writing within fourteen (14) Days, any verbal order or determination made by the A/E.
- b. The A/E shall have no authority to approve or order changes in the Work which alter the design concept or which call for an extension of the Contract Completion Date or Final Completion or a change in the Contract Price.
- c. The Owner shall have the right, but not the duty, to countermand any decision of the A/E and to follow or reject the advice of the A/E, including but not limited to acceptance of the Work, as it deems best in its sole discretion. In those instances where the A/E has been given authority to act, the A/E shall promptly do so, but in the case of disagreement between the A/E and the Owner, the decision of the Owner shall be final. The Contractor shall not be bound by any determination, interpretation or decision of the A/E contrary to the A/E's authority or that is not consistent with the Contract Documents. The party taking issue with the determination, interpretation or decision of the A/E shall give the other party written notice of such fact within fourteen (14) days after the determination, interpretation or decision is communicated by the A/E. In the actual performance of the Work, the Contractor shall proceed in accordance with instructions given by the A/E unless the Owner and the Contractor mutually agree in writing or by Change Order that the Contractor shall proceed otherwise.
- d. All orders from the Owner to the Contractor shall either be transmitted through the A/E or communicated directly to the Contractor and the A/E by the Owner.
- e. Should the Owner choose to employ another or different A/E, the status of the A/E so employed shall be the same as that of the former A/E.
- f. The A/E shall provide a progress report to the Owner and the Contractor after each A/E visit to the

Site. The report shall be in writing indicating the date, time of day, weather conditions and the names of the persons representing the A/E who participated in the visit. The report shall advise the Owner of any problems that were noted or observed and shall compare the A/E's observations of the actual progress of the Work with that reported by the Contractor. On the basis of its on-Site observations, the A/E will make every reasonable effort to guard the Owner against delays, defects, and deficiencies in the Work of the Contractor. The A/E shall have the authority to inspect the Work, to note and report Defective Work and deviations from the Contract Documents to the Owner, to reject Work, and to recommend to the Owner the suspension of the Work when necessary to prevent Defective Work from proceeding or being covered.

- g. The A/E shall not be responsible for construction means, methods, techniques, sequences or procedures (other than those expressly specified in the Contract Documents), or for safety precautions and programs in connection with the Work. The A/E shall not be responsible for the Contractor's failure to carry out the Contractor's own responsibilities.
- h. The A/E generally conveys written decisions and Notices to the Contractor through the Project Manager and shall generally receive information and Notices from the Contractor through the Project Manager unless otherwise agreed. The Owner may delegate from the A/E to the Project Manager certain inspection, verification, acceptance, rejection, and administrative duties and authority, but any such delegation shall be in writing and a copy thereof provided to the Contractor.
- i. The provisions of this Section are included as information only to describe the relationship between the Owner, A/E, and Contractor. No failure of the A/E to act in accordance with this Section shall relieve the Contractor from its obligations under the Contract or create any rights in favor of the Contractor against the Owner.

## 16. INSPECTION

- a. All material and workmanship shall be subject to inspection, examination and testing by the Owner, the A/E, the Project Inspector, authorized inspectors and authorized independent testing entities at any and all times during manufacture and/or construction. The A/E and the Owner shall have authority to reject Defective Work and non-conforming material and require its correction. Rejected workmanship shall be satisfactorily corrected and rejected material shall be satisfactorily replaced with proper material without charge therefore, and the Contractor shall promptly segregate and remove the rejected material from the Site. If the Contractor fails to proceed at once with replacement of rejected material and/or the correction of Defective Work, the Owner may replace such material and/or correct such Work and charge the cost to the Contractor, or may terminate the Contract as provided in Section 41 of these General Conditions, the Contractor and surety being liable for any damage to the same extent as provided in Section 41 for termination thereunder.
- b. Site inspections, tests conducted on Site and tests of materials gathered on Site which the Contract requires to be performed by independent testing entities shall be contracted and paid for by the Owner. Examples of such tests are the testing of cast-in-place concrete, foundation materials, soil compaction, pile installations, caisson bearings and steel framing connections. The Contractor shall promptly furnish, without additional charge, all reasonable facilities, labor and materials necessary and convenient for making such tests. Except as provided in (d) below, whenever such examination and testing finds Defective Work or non-conforming materials or equipment, the Contractor shall reimburse the Owner for the cost of reexamination and retesting. Although conducted by independent testing entities, the Owner will not contract and pay for tests or certifications of materials, manufactured products or assemblies which the Contract, codes, standards, etc., require to be tested and/or certified for compliance with industry standards such as Underwriters Laboratories, Factory Mutual or ASTM. If fees are charged for such tests and certifications, they shall be paid by the Contractor. The Contractor shall also pay for all inspections, tests, and certifications which the Contract specifically requires the Contractor to

perform or to pay, together with any inspections and tests which it chooses to perform for its own purposes, but which are not required by the Contract.

- c. Where Work is related to or dependent on Defective Work, the Contractor shall stop such related or dependent Work until the Defective Work is corrected or an alternative solution is presented that is satisfactory to the Owner. Where Work is rejected as Defective, the Contractor shall stop like Work in other areas or locations on the Project until the Owner has approved corrective measures.
- d. Should it be considered necessary or advisable by the Owner or the A/E at any time before the Final Completion Date to make an examination of any part of the Work already completed, by removing or tearing out portions of the Work, the Contractor shall promptly furnish all necessary facilities, labor and material to expose the Work to be tested to the extent required. If such Work is found to be Defective in any respect, the Contractor shall bear all the expenses of uncovering the Work, of examination and testing, and of satisfactory reconstruction and correction of the Defective Work. If, however, such Work is found to meet the requirements of the Contract, the actual cost of the Contractor's labor and material necessarily involved in uncovering the Work, the cost of examination and testing, and Contractor's cost of material and labor necessary for replacement of the examined Work including a markup of fifteen (15%) percent for overhead and profit, shall be paid to the Contractor and, if the Contract Completion Date was delayed thereby, a time extension equivalent to the impact on the Critical Path shall be issued by Change Order. Notwithstanding the foregoing, the Contractor shall be responsible for all costs and expenses in removing and replacing the Work if the Contractor had covered the Work prior to any inspection or test required by the Contract Documents or contrary to the instructions of the A/E, Owner, Project Inspector, or Building Official.

The Project Inspector has the authority to recommend to the A/E and the Owner that the Work be suspended when in his or her judgment the Contract Documents are not being followed. Any such suspension shall be continued only until the matter in question is resolved to the satisfaction of the Owner. The cost of any such Work stoppage shall be borne by the Contractor unless it is later determined that the Work in question was in full compliance with the Contract Documents.

- e. The Project Inspector has the right and the authority to:
  - 1. Inspect all construction materials, equipment, and supplies for quality and for compliance with the Contract Documents and/or approved shop drawings and Submittals.
  - 2. Inspect workmanship for compliance with the standards described in the Contract Documents.
  - 3. Observe and report on all tests and inspections performed by the Contractor.
  - 4. Recommend rejection of Work which does not conform to requirements of the Contract Documents or is Defective.
  - 5. Keep a record of construction activities, tests, inspections, and reports.
  - 6. Attend all Site construction meetings and inspections held by the Owner and/or the A/E with the Contractor.
  - 7. Check materials and equipment, together with documentation related thereto, delivered for conformance with approved Submittals and the Contract.
  - 8. Check installations for proper workmanship and conformance with shop drawings and installation instructions.

9. Assist in the review and verification of the Form CO-12, Schedule of Values and Certificate for Payment, submitted by the Contractor each month.
  10. Do all things for or on behalf of the Owner as the Owner may direct in writing.
- f. The Project Inspector has no authority to:
1. Authorize deviations from the Contract Documents;
  2. Enter into the area of responsibility of the Contractor's superintendent;
  3. Issue directions relative to any aspect of construction means, methods, techniques, sequences or procedures unless specifically required by the Contract Documents or in regard to safety precautions and programs in connection with the Work;
  4. Authorize or suggest that the Owner occupy the Project, in whole or in part; or
  5. Issue a certificate for payment.
- g. The duties of the Project Inspector are for the benefit of the Owner only and not for the Contractor. The Contractor may not rely upon any act, statement, or failure to act on the part of the Project Inspector, nor shall the failure of the Project Inspector to properly perform his or her duties in any way excuse Defective Work, improper performance of the Work, or noncompliance with the Contract Documents by the Contractor.

**17. SUPERINTENDENCE BY CONTRACTOR**

- a. The Contractor shall have a competent foreman or superintendent, satisfactory to the A/E and the Owner, on the Site at all times during the performance of the Work. The superintendent shall be familiar with and be able to read and understand the Contract Documents and be capable of communicating verbally and in writing with the Owner's representatives, the A/E, and the Contractor's workers. The Contractor shall be responsible for all construction means, methods, techniques, sequences and procedures, for coordinating all portions of the Work except where otherwise specified in the Contract Documents, and for all safety and worker health programs and practices. The Contractor shall notify the Owner, in writing, of any proposed change in foreman or superintendent, including the reason therefore, prior to making such change.
- b. The Contractor shall, at all times, enforce strict discipline and good order among the workers on the Project, and shall not employ on the Work, or contract with, any unfit person, anyone not skilled in the Work assigned to him or her, or anyone who will not work in harmony with those employed by the Contractor, the Subcontractors, the Owner or the Owner's separate contractors and their subcontractors or anyone who will not interact appropriately with the public.
- c. The Owner may, in writing, require the Contractor to remove from the Site any employee or Subcontractor's employee the Owner deems to be incompetent, careless, not working in harmony with others on the Site, not interacting appropriately with the public, or otherwise objectionable, but the Owner shall have no obligation to do so.

**18. CONSTRUCTION SUPERVISION, METHODS AND PROCEDURES**

- a. The Contractor shall be solely responsible for supervising and directing the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract. The Contractor shall be solely responsible for the means, methods, techniques, sequences and procedures of construction and for coordinating all portions of the Work, except where otherwise specified in the Contract Documents. The Contractor shall not be responsible for the negligence of others in the design or

selection of a specific means, method, technique, sequence or procedure of construction expressly required by the Contract. The Contractor is solely responsible to the Owner that the finished Work complies with the Contract Documents.

The Contractor shall be solely responsible for health and safety precautions and programs for workers and others in connection with the Work. No inspection by, knowledge on the part of, or acquiescence by the A/E, the Project Inspector, the Owner, the Owner's employees and agents, or any other Person shall relieve the Contractor from its sole responsibility for compliance with the requirements of the Contract and its sole responsibility for health and safety programs and precautions for the Work.

- b. If a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Contract Documents, the Contractor may furnish or utilize a substitute means, method, sequence, technique or procedure of construction acceptable to the A/E, subject to the Owner's right to disapprove. The Contractor must submit its written request for the substitution to the A/E with sufficient information to allow the A/E to determine that the substitute proposed is equivalent to that indicated or required by the Contract.
- c. The Plans and Specifications are divided into several parts, or sections, for convenience only and because the entirety of the Plans and Specifications must be considered and construed as a whole. The divisions of the Plans and Specifications are not intended to control the Contractor in dividing the Work among Subcontractors or to limit the Work performed by any trade. The Contractor shall be solely responsible for the coordination of the trades, Subcontractors and vendors engaged in the Work and for the compensation of the trades, Subcontractors and vendors for the Work performed.

## 19. SCHEDULE OF THE WORK

- a. **General:** The Contractor is responsible for the scheduling and sequencing of the Work, for coordinating the Work, for monitoring the progress of the Work, and for taking appropriate action to keep the Work on schedule to finish on or before the Contract Completion Date. The Contractor may attempt to achieve Substantial Completion before the Contract Completion Date and receive payment in accordance with Section 36 for the Work completed each period. However, the Contract Completion Date shall be used in all schedules and schedule updates as the deadline for which Substantial Completion is to be achieved. The time (in Days) between the Contractor's planned early completion and the Contract Completion Date is part of the Float. Extensions of time allowed pursuant to Sections 38, 39, and 43, the determination of any compensation for compensable delay, and all other matters between the Owner and the Contractor will be determined using the Contract Completion Date, not an earlier Substantial Completion date planned by the Contractor.

Within two (2) weeks after the Contractor signs the Contract, unless otherwise extended by the Owner at the time of the signing, the Contractor shall prepare and submit to the Owner, with a copy to the A/E, a schedule for achieving Substantial Completion by the Contract Completion Date. The preliminary schedule shall be in sufficient detail to show the sequencing of the various trades for each floor level, wing or work area. The Owner will notify the Contractor of any comments on the preliminary schedule within fifteen (15) Days of receipt by the Owner.

A fully complete Project schedule meeting the requirements set forth below in subparagraph (1) or (2), as applicable, must be submitted no later than sixty (60) Days after the Contract is signed by the Owner.

- 1. For Contracts with a Contract Price less than \$1,500,000, a "critical path method" or bar graph schedule may be utilized. The schedule shall indicate the estimated starting and completion dates for each major element of the work and satisfy the requirements of Section 19 (b) below.

2. For Contracts with a Contract Price of \$1,500,000 or more, a “critical path method” schedule shall be utilized to control the planning and scheduling of the Work. The “critical path method” schedule shall be the responsibility of the Contractor and shall be paid for by the Contractor and shall satisfy the requirements of Section 19(c) below.

It is the Contractor’s responsibility to submit a schedule that shows Substantial Completion of the Work by the Contract Completion Date and completion of any portions of the Work by any interim deadlines established by the Contract.

The Contractor shall allow sufficient time in the schedule for the A/E to conduct all reviews and inspections required under the A/E Contract with the Owner. If the A/E and the Contractor are unable to agree as to what constitutes sufficient time, the Owner shall determine the appropriate duration for such A/E activities.

The Owner and A/E review schedules and schedule-related submittals solely for compliance with the requirements of this Section. The Owner’s failure to reject or its acceptance of any schedule, graph, chart, recovery schedule, updated schedule, plan of action, monthly status report, or similar schedule-related submittals, shall not constitute a representation, admission, or warranty by the Owner, including but not limited to a representation, admission, or warranty that the schedule is feasible or practical or that contents therein are true or accurate, nor shall any such acceptance or failure to reject relieve the Contractor from sole responsibility for completing the Work by the Contract Completion Date.

No progress payments will be payable to the Contractor until after it has submitted a preliminary schedule which is acceptable to the Owner. Neither the second progress payment nor any subsequent payment shall be payable to the Contractor until it has submitted a fully complete Project schedule accepted by the Owner. No subsequent progress payments will be payable to the Contractor unless it submits each monthly Project report required by Section 19(d) in a form accepted by Owner and each recovery schedule required by Owner pursuant to Section 19(e).

Failure to provide a satisfactory preliminary schedule, fully complete Project schedule, or monthly Project report within the time limits stated above shall be a material breach for which the Owner may terminate the Contract in the manner provided in Section 41 of these General Conditions.

- b. **Bar Graph Schedule:** Where a bar graph schedule is allowed, it shall be time-scaled in weekly increments, shall indicate the estimated starting and completion dates for each major element of the Work by trade and by area, level, or zone, and shall schedule dates for all salient features and activities, including but not limited to the placing of orders for materials, submission of Shop Drawings and other Submittals for review, approval of Shop Drawings and Submittals by A/E, the manufacture and delivery of material, the testing and the installation of materials, supplies and equipment, and all Work activities to be performed by the Contractor. Each Work activity will be assigned a duration by the Contractor. One Day shall be the time unit used. The bar graph shall establish and show the Critical Path for the Work.
- c. **Critical Path Method Schedule:** Where a Critical Path method schedule is required, it shall be in the time-scaled precedence format using the Contractor’s logic and time estimates. The Critical Path method schedule shall be drawn or plotted with activities grouped or zoned by Work area or Subcontract rather than random (or scattered) format.

The Critical Path method schedule shall be time-scaled on a weekly basis and shall be drawn or plotted at a level of detail and logic which will schedule all salient features and activities of the Work, including not only the actual construction Work for each trade, but also the submission of Shop Drawings and Submittals for review, approval of Shop Drawings and Submittals by the A/E, placing of orders for materials, the manufacture and delivery of materials, the testing and installation of materials and equipment, and all Work activities to be performed by the Contractor.

The Critical Path method schedule shall have no line-item activities longer than thirty (30) Days in duration, and activities shall be included to provide sufficient detail for effectively managing the sequence of the Work. Failure to include any element of Work required for the performance of this Contract shall not excuse the Contractor from completing all Work required within the Time for Completion and by the Contract Completion Date and any interim deadlines established by the Contract. Each Work activity will be assigned a duration by the Contractor.

When completed, the Critical Path method schedule shall be submitted to the A/E and the Owner for review. The Critical Path method schedule will identify and describe each activity, state the duration of each activity, the calendar dates for the early and late start and the early and late finish of each activity, any constraints placed upon the activity, and clearly depict all activities on the Critical Path for the Work. Float and Free Float shall be indicated for all activities. Float, whether Free Float or Total Float, shall not be considered for the exclusive use or benefit of either the Owner or the Contractor, but must be allocated in the best interest of completing the Work by the Contract Completion Date.

On contracts with a price over \$5,000,000, each activity on the Critical Path method schedule shall also be attributable to, and correlate with, each activity on the Schedule of Values, the sum of which for all activities shall equal the Contract Price.

When accepted by the Owner and the A/E as compliant with the requirements of this Section, the schedule shall become the baseline Critical Path method schedule for the Project. Acceptance of the schedule by the Owner does not indicate agreement with, nor responsibility for, the proposed or actual duration of any activity or logic shown on the accepted schedule.

- d. **Monthly Project Reports:** The Contractor shall review progress of the Work not less than each month, but as often as necessary to properly manage the Project and stay on schedule to finish before the Contract Completion Date. The Contractor shall collect and preserve information on Change Orders, including extensions of time. The Contractor shall evaluate this information and update the latest accepted schedule as often as necessary to finish before the Contract Completion Date. The Contractor shall submit to the A/E along with each Certificate for Payment a copy of the bar graph schedule annotated to show the current progress or, for projects requiring a Critical Path method schedule, a monthly report of the status of all activities. The bar graph schedule or monthly status report submitted with each Certificate for Payment shall show the Work completed to date in comparison with the Work scheduled for completion, including but not limited to the dates for the beginning and completion of the placing of orders and the manufacture, testing and installation of materials, supplies and equipment. The form for these reports shall be approved by the A/E and the Owner prior to submission of the first Certificate for Payment. If any elements of the Work are behind schedule, regardless of whether they may prevent the Work from being completed on time, the Contractor must indicate in writing in the report what measures it is taking and plans to take to bring each such element back on schedule and to ensure that the Work is completed before the Contract Completion Date.
- e. **Progress Delay:** Should any of the following conditions exist, the Owner may require that the Contractor prepare, at no extra cost to the Owner, a plan of action and a recovery schedule for completing the Work by the Contract Completion Date:
  - 1. The Contractor's monthly project report indicates delays that, in the judgment of the A/E or the Owner, call into question the Contractor's ability to complete the Work by the Contract Completion Date;
  - 2. The Critical Path method schedule sorted by early finish dates shows the Contractor to be thirty (30) or more Days behind on the Critical Path schedule at any time during the Work, up to thirty (30) Days prior to the Contract Completion Date;
  - 3. The Contractor desires to make changes in the logic or sequencing of Work activities or

the planned duration of future activities of the Critical Path method schedule which, in the judgment of the A/E or the Owner, are of a significant departure from those of the baseline schedule or prior schedule updates.

The plan of action and recovery schedule, when required, shall contain a narrative explanation and display how the Contractor intends to regain compliance with the most current and Owner accepted Critical Path method schedule, as updated with approved Change Orders, if any.

The plan of action shall be submitted to the Owner for review within two (2) business days of the Contractor receiving the Owner's written request. The recovery schedule, when required, shall be submitted to the Owner within five (5) Days of the Contractor's receiving the Owner's written request.

- f. **Early Completion of Project:** The Contractor may attempt to achieve Substantial Completion before the Contract Completion Date. However, such planned early completion shall be for the Contractor's convenience only and shall not create any additional rights of the Contractor or obligations of the Owner under this Contract, nor shall it change the Time for Completion or the Contract Completion Date. The Contractor shall not be required to pay damages to the Owner because of the Contractor's failure to achieve Substantial Completion by any planned earlier date. Likewise, the Owner shall not pay the Contractor any additional compensation for achieving Substantial Completion prior to the Contract Completion Date nor will the Owner owe the Contractor any compensation should the Owner, its officers, employees, or agents cause the Contractor not to achieve Substantial Completion earlier than the Contract Completion Date.

Contractor may request or propose to change the Contract Completion Date to reflect an earlier Substantial Completion date. The Owner may, but is not required to, accept such proposal. However, a change in the Time for Completion or the Contract Completion Date shall be accomplished only by Change Order. If the Contractor's proposal to change the Time for Completion or the Contract Completion Date is accepted, a Change Order will be issued stating that all references in the Contract, including these General Conditions, to the Time for Completion or the Contract Completion Date shall thereafter refer to the date as modified, and all rights and obligations, including the Contractor's liability for actual damages, delay damages and/or liquidated damages, shall be determined in relation to the date, as modified.

## 20. SCHEDULE OF VALUES AND CERTIFICATE FOR PAYMENT

- a. Before submittal of the first Certificate for Payment, the Contractor shall prepare for review and approval of the A/E and the Owner the Schedule of Values listed by trades or by Specifications sections for the Work, the total for which equals the Contract Price. Where the Work has multiple parts or phases, the Contractor shall prepare appropriate Schedules of Values to facilitate reviews of Certificate for Payment submitted for each part or phase.

All Certificates for Payment shall be made in the ASTM Uniformat II structure on the Form CO-12, Schedule of Values and Certificate for Payment.

- b. If the Contractor requests, or intends to request, payment for materials stored in an approved and secure manner, the Schedule of Values must indicate the amount for labor and the amount for materials, and in a supplement thereto must include an itemized list of materials for that trade or Work section. The material breakdown shall be in sufficient detail to allow verification of the quantities required for the Project, the quantities delivered, the Work completed, and the quantities stored on or off-Site.
- c. The Contractor shall complete the "Value of Work Completed" portion of the Form CO-12, complete and sign the Contractor's certification, and attach all substantiating material each Certificate for Payment. Such substantiating material includes, but is not limited to, invoices for materials, delivery tickets, timesheets, payroll records, daily job logs/records, and similar materials

which, in the opinion of the Owner and the A/E, are necessary or sufficient to justify payment of the amount requested.

- d. The labor progress for any task or activity shall be calculated based upon the percentage of Work complete up to fifty percent (50%) of the completion of the task or activity. Thereafter, the evaluation of labor progress will be based upon the effort required to complete that task or activity. The material progress shall be calculated as the invoiced dollar cost of materials used in relation to the amount estimated as necessary to complete a particular element of Work. When calculating material progress, credit shall be given for installed material as well as that stored on the Site and any material stored off-Site which has been certified by the A/E in accordance with Section 36 of these General Conditions.
- e. Should Work included in previous Certificates for Payment, and for which payment has been made, subsequently be identified by tests, inspection, or other means, as Defective or not acceptable or not conforming to the Contract Documents, the "Value of Work Completed" portion of the first Certificate for Payment submitted after such identification shall be modified to reduce the "completed" value of that Work to a percentage reflecting only that work which is not Defective or nonconforming.

## **21. ACCESS TO WORK**

The A/E, the Owner, the Project Manager, the Owner's inspectors and other testing personnel, the Building Official, inspectors from the Department of Labor and Industry, and others authorized by the Owner, shall have access to the Work at all times. The Contractor shall provide proper facilities for access and inspection.

## **22. SURVEYS AND LAYOUT**

- a. The Owner shall furnish the Contractor documents showing property lines and the location of existing buildings and improvements at the Site. The Contractor shall provide competent surveying and engineering services to execute the Work and shall be responsible for the accuracy of those surveying and engineering services.
- b. The Owner shall provide the general reference points and benchmarks on the Site as required of it by the Plans and Specifications. If the Contractor finds that any previously established reference points have been lost or destroyed, it shall promptly notify the A/E.
- c. The Contractor shall protect and preserve the established benchmarks and monuments and shall make no changes in locations without prior written Notice to the A/E and prior written approval from the Owner. Benchmarks and monuments that are lost or destroyed or which require shifting because of necessary changes in grades or locations shall, subject to prior written approval of the Owner, be replaced and accurately located by the Contractor.

## **23. PLANS AND SPECIFICATIONS**

- a. The general character and scope of the Work are illustrated and described by the Plans and the Specifications. If the Contractor deems additional detail or information to be needed, the Contractor shall request the same in writing from the A/E. The request shall precisely state the detail or information needed and shall explain why it is needed. The Contractor shall also indicate a date by which the requested information is required. The A/E shall provide by Field Order such further detail and information as is necessary by the date required so long as the date indicated is reasonable. Any additional drawings and instructions supplied to the Contractor shall be consistent with the Contract Documents, shall be true developments thereof, and shall be so prepared that they can be reasonably interpreted as a part thereof. The Contractor shall carry out the Work in accordance with the additional detail drawings and instructions at no additional cost to the Owner and with no time extension.

- b. If the Contractor finds a conflict, error, omission, or other discrepancy in the Plans or Specifications, he shall notify the A/E in writing as soon as possible, but before proceeding with any Work that is or may be impacted by the matter. The A/E shall issue a clarification by Field Order to the Contractor stating the correct requirements. If the Contractor deems the Field Order requires additional or extra Work, it shall provide Notice of its request for additional time and/or compensation to the Owner and A/E prior to proceeding with that Work. The Contractor also shall submit a request for Change Order along with a detailed substantiating cost proposal through the A/E to the Owner within fourteen (14) Days of the receipt of the Field Order or before proceeding with the Work, whichever is earlier.
- c. If a conflict, error, omission or other discrepancy in Plans or Specifications was reasonably apparent or with reasonable diligence should have been apparent to the Contractor prior to submitting its bid or Proposal, and the Contractor failed to submit a question to the A/E in the time and manner required by the Instructions to Bidders, then the Contractor shall not be entitled to additional compensation or time or entitled to bring a claim against the Owner based on such conflict, error, omission or other discrepancy. If the Contractor performs any Work, or is delayed in performing any Work, where such Work involves a conflict, error, omission, or other discrepancy in the Plans or Specifications that the Contractor knew about, or with reasonable diligence should have known about, for which the Contractor failed to provide Notice to the A/E and Owner as required, the Contractor shall assume full responsibility for the Work or delay and shall bear all costs attributable to correcting any Work requiring correction or to any delay, and such conflict, error, omission, or other discrepancy shall not be the basis for a claim against or any recovery from the Owner.
- d. In case of differences between a small and large scale Drawing, the large scale Drawing shall govern. Where on a Drawing a portion of the Work is drawn out and the remainder is indicated in outline, the parts drawn out shall apply also to all other like portions of the Work.
- e. Where the word “similar” appears on a Drawing, it shall be interpreted in its general sense and not as meaning “identical,” and all details shall be worked out in relation to their location and their connection with other parts of the Work.
- f. Measurements or dimensions shown on the Drawing for Site features, utilities, buildings, structures, or improvements shall be verified at the Site by the Contractor before commencing the Work. The Contractor shall not scale measurements or dimensions from a Drawing. If there are discrepancies among Drawings or the Plans, the Contractor shall notify and request clarification from the A/E before proceeding with the impacted Work. If new Work is to connect to, match with or be provided in existing facilities, buildings, or improvements, the Contractor shall verify the actual existing conditions and necessary dimensions prior to ordering or fabrication of materials or construction.
- g. As-Built Drawings: The Contractor shall maintain at the Site for the Owner one copy of the As-Built Drawings in good order and marked to record all changes as they occur during construction. These shall be available to the A/E, the Owner, the Project Inspector, the Owner’s other inspectors and to the Owner’s testing personnel
- h. Preparation of Record Drawings: Upon completion of the Work and prior to the final inspection, the Contractor shall deliver to the A/E, for preparation of the Record Drawings, one complete set of “As Built” Drawings depicting the Work in its as-built condition at Final Completion.

## **24. SUBMITTALS AND PROJECT RECORDS**

- a. The Contractor shall submit a listing of all Submittals required by the A/E or which the Contractor identifies as necessary, stating the dates for the submission of each Submittal. The listing shall be in a format acceptable to the A/E. The Contractor shall identify all Submittals with the Owner’s

Project Code Number as required by Section 24(e).

- b. Submittals shall be forwarded to the A/E for approval if required by the Specifications or if requested by the A/E or the Owner. No part of the Work dealt with by a Submittal shall be ordered, fabricated or installed by the Contractor, except at its own risk, until the Submittal for that Work has been approved.

Working drawings, Shop Drawings and/or Submittals for fire protection, fire alarm, fire detection and security systems shall be submitted to, and approved by, first the A/E and then the Building Official prior to ordering, fabricating or installing such systems. The Contractor shall be solely responsible for obtaining such approvals. No part of the Work involving such systems shall be ordered, fabricated or installed by the Contractor until such approvals have been obtained.

- c. The Contractor shall furnish to the A/E for approval, the name of the manufacturer, the model number, and other identifying data and information respecting the performance, capacity, nature and rating of the machinery and mechanical and other equipment which the Contractor contemplates incorporating in the Work. When Submittals are required by this Contract for materials, the Contractor shall furnish full information concerning the material or articles which the Contractor intends to incorporate in the Work. When required, samples shall be submitted for approval at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material and articles installed or used without required approval shall be at the risk of subsequent rejection.
- d. Unless otherwise indicated or required by the Specifications, Shop Drawings shall be submitted in the form of one reproducible tracing and three blue-line or black-line prints. Catalog cuts, product data and other non-reproducible literature, except certificates, shall be submitted in six (6) copies minimum, of which three (3) will be retained by the A/E and the remainder will be returned to the Contractor. The Contractor shall maintain one copy of all approved Shop Drawings and Submittals in the construction trailer for use by inspectors. If agreed by the Owner, A/E, and Contractor, Submittals may be provided in electronic format in lieu of hardcopy format.
- e. Submittals shall be accompanied by a letter of transmittal which shall list the Project Code Number, the Submittals included, and the date. Submittals shall be complete in every respect and bound in sets. Each Submittal shall be clearly marked to show each item, component and/or optional feature proposed to be incorporated into the Work. Each Submittal shall contain specific references to the sections of the Plans and Specifications to which the item or component that is the subject of the Submittal relates.
- f. The Contractor shall check Submittals for compliance with the requirements of the Contract Documents. The Contractor shall clearly note in writing any and all items which deviate from the requirements of the Contract Documents. Reasons for deviation shall be included with the Submittal. The Contractor shall be solely responsible for checking all dimensions and coordinating all materials and trades to ensure that the components or products proposed, individually or in combination, will fit in the space available and that they will be compatible with other components or products provided.

- g. After checking each Submittal, the Contractor shall stamp each sheet of the Submittal with the Contractor's review stamp. Data submitted in a bound volume or on one sheet printed on two sides, may be stamped on the front of the first sheet only. The Contractor's review stamp shall be worded as follows:

The equipment and material shown and marked in this Submittal is proposed to be incorporated into this Project, is in compliance with the Contract Plans and Specifications unless otherwise shown in bold-face type or lettering and listed on a page or pages captioned "**DEPARTURES FROM PLANS AND SPECIFICATIONS**", and can be installed in the allocated spaces.

Reviewed by \_\_\_\_\_ Date \_\_\_\_\_

The person signing the review stamp shall be the person designated in writing by the Contractor as having that authority. The identity of such individual shall be forwarded to the A/E prior to or with the first Submittal. The signature on the review stamp shall be handwritten in ink, or in the case of electronic submittals, electronically signed in accordance with *Code of Virginia* § 59.1-479 *et seq.* Stamped signatures are not acceptable.

- h. The Contractor shall forward all Submittals sufficiently in advance of construction activities and requirements to allow sufficient time for checking, correcting, resubmitting and rechecking each Submittal.
- i. If a Submittal indicates a departure from the Contract Documents, the A/E may reject the Submittal or recommend it to the Owner, who shall approve or reject it as the Owner, in its sole discretion, sees fit. Any departure from the Contract Documents must be authorized by a Change Order if it results in adjustment of the Contract Price or the Contract Completion Date.
- j. The A/E is responsible to the Owner, but not to the Contractor, to verify that the information, equipment and materials depicted in Submittals conform to the design concept and functional requirements of the Plans and Specifications, that the detailed design portrayed in Shop Drawings and proposed equipment and materials shown in Submittals are of the quality specified and will function properly, and that the Submittals comply with the Contract Documents.
- k. The Work shall be in accordance with approved Submittals. Approval of the Contractor's Submittals by the A/E does not relieve the Contractor from responsibility for complying with the Contract Documents.
- l. The Plans and/or Specifications may indicate that the A/E designed or detailed a portion of the Work-around a particular product. Should a different product be proposed by the Contractor and accepted, all modifications, rerouting, relocations and variations required for proper installation and coordination to comply with the design concept and requirements of the Contract Documents shall be the responsibility of the Contractor and shall be made at no extra cost to the Owner. If the plans were noted as designed or detailed around a particular product and/or if a product is named when a "brand name or equal" requirement has been used, other products may be utilized following Section 26 of these General Conditions.
- m. Additional Submittal requirements are shown in the Specifications.
- n. Ownership of all materials and documentation including Shop Drawings, BIM models, copies of any calculations and analyses prepared and other Project-specific details of building components created during the Submittal process shall belong exclusively to the Owner. These materials and documentation, whether completed or not, shall be the property of the Commonwealth of Virginia, whether the Work for which they are made is executed or not. The Contractor shall not use these materials on any other work or release any information about these materials without the express written consent of the Owner.

Such material may be subject to public inspection in accordance with the Virginia Freedom of Information Act. Trade secrets or proprietary information submitted by a bidder, offeror, or contractor in connection with a procurement transaction shall not be subject to disclosure under the Virginia Freedom of Information Act, provided the bidder, offeror, or contractor timely invoked the protections of *Code of Virginia* § 2.2-4342(F).

- o. The Contractor shall maintain comprehensive records of all documentation produced in the performance of the Work and maintain a records management system to provide for document tracking, organization, storage and archiving of such documentation. The Contractor's records management system shall provide for the electronic storage and transmission of Project documents and information through one or more of the following methods: (1) web accessible project management software; (2) electronic files shared utilizing removable electronic media; (3) paper copies of documentation; or (4) in such manner agreed to by the Owner and Contractor. Such records shall be retained by the Contractor for a period of five (5) years following the Final Completion Date. The Contractor shall make the project documentation available to the Owner within five (5) Days of request in an orderly, indexed manner to allow individual documents to be easily located and reviewed. The Contractor shall ensure all documentation is kept current and stored in the records management system in a timely manner.
- p. The Contractor's Project documentation shall include regular construction photographs to show progress of the Work and items that are or may be the subject of Contractor or Subcontractor claims. The photographer shall label each photograph with, at a minimum, the Project name, building name/number, City, State, name of Contractor/Subcontractor(s) whose work is depicted, date and time the photograph was taken, description of weather conditions, subject matter and viewpoint of the photograph, name of the photographer, and the names of any observers.

## **25. FEES, SERVICES AND FACILITIES**

- a. The Contractor shall obtain all permits, except the Building Permit, and pay for all fees and charges necessary for temporary access, public right-of-way blockage or use, temporary connections to utilities, and the use of property (other than the Site) for storage of materials and other purposes, unless otherwise specifically stated in the Contract Documents.
- b. Certain projects such as renovations and interior modifications of existing buildings will usually have water and electric service to the building. In those instances, water and electric power, if required for the Work under the Contract, will be furnished by the Owner subject to reasonable use by the Contractor, but only to the extent and capacity of present services. The Contractor shall be responsible for providing required connections, temporary wiring, piping, etc. to these services in a safe manner and in accordance with applicable codes. All temporary wire, pipe, etc. shall be removed before the Substantial Completion inspection. Acceptance by the Contractor of the use of Owner's water and electricity constitutes a release to the Owner of all claims and of all liability to the Contractor for any damages which may result from the use of such utilities and power and water outages or voltage variations.
- c. The Owner shall pay any connection charges for permanent utility connections directly to the utility Supplier. The Contractor shall coordinate such connections with the utility Supplier.
- d. It is understood that, except as otherwise specifically stated in the Contract Documents, the Contractor, either directly or through its Subcontractors, shall provide and pay for all material, labor, tools, equipment, water, light, power, telephone and other services or facilities of every nature whatsoever necessary to execute completely and deliver the Work before the Contract Completion Date.
- e. The Contractor shall provide all required temporary facilities, including Contractor's office space,

Owner's Project Inspector's office space (if required by the Specifications), sanitary facilities, and storage space, as required for the operations and the protection of the materials and the Work. Number, sizes and locations shall be subject to approval of the Owner. Sanitary facilities shall be plumbed into an approved waste treatment system or shall be an approved type of chemical toilet and shall be regularly serviced.

- f. Use and occupancy of the construction site as the Owner's Project Inspector's office or as a work or meeting space for other than contractor employees prior to receipt of a Certificate of Use and Occupancy is prohibited.

## 26. EQUALS

- a. **Brand names:** Unless otherwise stated in the Specifications, the identification of a certain brand, make or manufacturer denotes the characteristics, quality, workmanship, economy of operation and suitability for the intended purpose of the article to be supplied, but does not restrict the Contractor to the specific brand, make, or manufacturer indicated. Rather, the information conveys to the Contractor the general style, type, character and quality of the article to be supplied.
- b. **Equal materials, equipment or assemblies:** Whenever in these Contract Documents a particular brand, make of material, device or equipment is shown or specified, such brand, make of material, device or equipment shall be regarded merely as a standard. Any other brand, make or manufacturer of a product, assembly or equipment which in the opinion of the A/E is the equal of that specified, considering quality, capabilities, workmanship, configuration, economy of operation, useful life, compatibility with design of the Work, and suitability for the intended purpose, will be accepted unless rejected by the Owner as not being equal.
- c. **Substitute materials, equipment or assemblies:** The Contractor may propose to substitute a material, product, equipment, or assembly which deviates from the requirements of the Contract Documents but which the Contractor deems will perform the same function and have equal capabilities, service life, economy of operations, and suitability for the intended purpose. The proposal must include any cost differentials proposed. The Owner will have the A/E provide an initial evaluation of such proposed substitutes and provide a recommendation on acceptability and indicate the A/E's redesign fee to incorporate the substitution into the Contract Documents. The Owner shall have the right to limit or reject substitutions at its sole discretion.
- d. The Contractor shall be responsible for making all changes in the Work necessary to adapt and accommodate any equal or substitute product approved for use by Owner. The necessary changes shall be made at the Contractor's expense.

## 27. AVAILABILITY OF MATERIALS

If a brand name, material, product, or model number included in the Contract Documents is not available on the present market, alternate equal materials, products or model numbers may be proposed by the Contractor through the A/E for approval by the Owner through the process set forth in Section 26.

## 28. CONTRACTOR'S TITLE TO MATERIALS

No materials or supplies for the Work shall be purchased by the Contractor, or by any Subcontractor or Supplier, subject to any security interest, installment or sales contract or any other agreement or lien by which an interest in the materials or supplies is retained by the seller or is given to a secured party. The Contractor warrants that it has clear and good title to all materials and supplies used in the Work or for which the Contractor accepts payment in whole or in part.

## 29. STANDARDS FOR MATERIALS INSTALLATION & WORKMANSHIP

- a. Unless otherwise specifically provided in the Contract, all equipment, material, and accessories incorporated in the Work are to be new or Recycled and in first-class condition.
- b. Unless specifically approved by the Owner or required by the Contract, the Contractor shall not incorporate into the Work any materials containing asbestos or any material known by the industry to be hazardous to the health of building construction workers, maintenance workers, or occupants, or harmful to other building components, materials or products. If the Contractor becomes aware that a material required by the Contract contains asbestos or other hazardous or harmful materials, it shall notify the Owner and the A/E immediately and shall take no further steps to acquire or install any such material without first obtaining Owner approval.
- c. All workmanship shall be of the highest quality found in the building industry in every respect. All items of Work shall be done by Persons skilled in the particular task or activity to which they are assigned. In the acceptance or rejection of Work, no allowance will be made for lack of skill on the part of Persons performing the Work. Poor or inferior workmanship (as determined by the A/E, the Owner or other inspecting authorities) shall be removed and replaced at Contractor's expense such that the Work conforms to the highest quality standards of the trades concerned, or otherwise corrected to the satisfaction of the A/E, the Owner, and other inspecting authority, as applicable.
- d. Where materials, supplies or equipment are supplied with the manufacturer's printed instructions, recommendations, or directions for installation, or where such instructions, recommendations, or directions are available, installation of the items shall be in strict accordance with the manufacturer's printed instructions unless those instructions contradict the Plans or Specifications, in which case the Contractor shall notify the A/E of the inconsistency and obtain written guidance from the A/E before proceeding with any Work involving the item.
- e. Where the Specifications or Plans refer to specific codes or standards governing the installation of specified items, installation shall in all cases be in strict accordance with the referenced codes and standards. Where no reference is made to specific codes or standards, installation shall conform to the generally recognized applicable standards for first-class installation of the specific item to be installed. Contractors are expected to be proficient and skilled in their respective trades and knowledgeable of the Codes and Standards of the National Fire Protection Association ("NFPA"), National Electric Code ("NEC"), Occupational Safety and Health Act ("OSHA") and other codes and standards applicable to installations and associated work by trade.
- f. Where the manufacturer's printed instructions are not available for installation of specific items, where specific codes or standards are not referenced to govern the installation of specific items, or where there is uncertainty on the part of the Contractor concerning the installation procedures to be followed or the quality of workmanship to be maintained in the installation of specific items, the Contractor shall consult, in advance, with the A/E for approval of the installation procedures or the specific standards governing the quality of workmanship the Contractor proposes to follow or maintain during the installation of the items in question.
- g. During and/or at the completion of installation of any items, the tests designated in the Plans or Specifications necessary to assure proper and satisfactory functioning for its intended purpose shall be performed by the Contractor or by its Subcontractor responsible for the completed installation. All costs for such testing are to be included in the Contract Price. If required by the Contract Documents, the Contractor shall furnish prior to final inspection the manufacturers' certificates evidencing that products meet or exceed applicable performance, warranty and other requirements, and certificates that products have been properly installed and tested.

### **30. WARRANTY OF MATERIALS AND WORKMANSHIP**

- a. The Contractor warrants that, unless otherwise specified, all materials and equipment incorporated in the Work shall be new or Recycled, in first-class condition, and in accordance with the Contract

Documents. The Contractor further warrants that the Work shall be of the highest quality and in accordance with the Contract Documents and shall be performed by Persons qualified at their respective trades.

- b. Work not conforming to these warranties shall be considered Defective.
- c. This warranty of materials and workmanship is separate and independent from and in addition to any of the Contractor's other guarantees and obligations in the Contract Documents and under Virginia law.

**31. USE OF SITE AND REMOVAL OF DEBRIS**

- a. The Contractor shall:
  - 1. Perform the Work in such a manner as not to interrupt or interfere with the operation of any existing activity on, or in proximity to, the Site or with the Work of any other separate contractor;
  - 2. Store its apparatus, materials, Supplies and equipment in such orderly fashion at the Site of the Work as will not unduly interfere with the progress of its Work or the work of any other separate contractor; and
  - 3. Place upon the Work or any part thereof only such loads as are consistent with the safety of that portion of the Work.
- b. The Contractor expressly undertakes, either directly or through its Subcontractor(s), to effect all cutting, filling or patching of the Work required to make the same conform to the Plans and Specifications, and, except with the consent of the A/E, not to cut or otherwise alter the work of any other separate contractor. The Contractor shall not damage or endanger any portion of the Work or Site, including existing improvements, unless called for by the Contract.
- c. The Contractor expressly undertakes, either directly or through its Subcontractor(s), to clean up frequently all refuse, rubbish, scrap materials and debris caused by its operations, to ensure that at all times the Site shall present a neat, orderly and workmanlike appearance. No refuse, rubbish, scrap material or debris shall be left within the completed Work nor buried on the Site, but shall be removed from the Site and properly disposed of in a licensed landfill or otherwise as required by law.
- d. The Contractor expressly undertakes, either directly or through its Subcontractor(s), before Final Payment or such prior time as the Owner may require: to remove all surplus material, false Work, temporary structures, including foundations thereof, plants of any description and debris of every nature resulting from its operations and to put the Site in a neat, orderly condition; to thoroughly clean and leave reasonably dust-free all finished surfaces, including all equipment, piping, etc., on the interior of all buildings; and to clean thoroughly all glass installed under the Contract, including the removal of all paint and mortar splatters and other defacements.

If the Contractor fails to clean up as required herein, the Owner may do so and charge the costs incurred thereby to the Contractor in accordance with Section 10 (b).

- e. The Contractor shall have, on-Site, an employee certified by the Department of Environmental Quality as a Responsible Land Disturber who shall be responsible for the installation, inspection and maintenance of erosion control and stormwater management measures and devices. The Contractor shall identify this employee to the Owner and the A/E in writing prior to any land disturbance on Site. The Contractor shall prevent Site soil erosion, the runoff of silt and/or debris carrying water from the Site, and the blowing of debris off the Site in accordance with the applicable requirements and standards of the Contract and the Virginia Department of

Environmental Quality's Erosion and Sediment Control Regulations and the Virginia Stormwater Management Regulations.

**32. TEMPORARY ROADS**

Temporary roads, if required, shall be established and maintained until permanent roads are accepted, then removed and the area restored to the conditions required by the Contract Documents. Crushed rock, paving and other road materials from temporary roads shall not be left on the Site unless written permission is received from the Owner to bury the same at a location and depth approved by the Owner.

**33. SIGNS**

The Contractor may, at its option and without cost to the Owner, erect signs acceptable to the Owner on the Site for the purpose of identifying and giving directions to the Project. No signs shall be erected without prior approval of the Owner as to design, content and location.

**34. PROTECTION OF PERSONS AND PROPERTY**

- a. The Contractor expressly undertakes both directly and through its Subcontractors, to take every reasonable precaution at all times for the protection of all Persons and property at or near the Site or which may be affected by the Contractor's Work.
- b. The Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Any violation of safety requirements or duties or any potential safety hazard that is known to the Contractor or which is brought to the attention of the Contractor by the A/E, the Owner, or any other Persons shall be immediately abated.
- c. The provisions of all rules and regulations governing health and safety as adopted by the Safety Codes Commission of the Commonwealth of Virginia, issued by the Department of Labor and Industry under Title 40.1 of the *Code of Virginia*, shall apply to all Work under this Contract.
- d. The Contractor shall continuously maintain adequate protection of all the Work and Site from damage and shall protect the Owner's property from injury or loss arising in connection with the Work. The Contractor shall make good any damage, injury or loss caused by its operations or the Work, except as may be directly and solely due to errors in the Contract Documents or caused by agents or employees of the Owner. The Contractor shall adequately protect adjacent property to prevent any damage to it or loss of use and enjoyment by its owners. The Contractor shall provide and maintain all passageways, guard fences, lights and other facilities for protection of Persons and the Site and the Work as required by public authority, local conditions, or the Contract.
- e. In an emergency affecting the health, safety, or life of Persons, or threatening loss or damage to the Work or adjoining property, the Contractor, without special instruction or authorization from the A/E or the Owner, shall act promptly, at its discretion, to prevent such threatened loss or injury. The Contractor shall carry out any instructions or directives issued by the A/E or Owner, to prevent threatened loss or injury, immediately, without appeal. Any additional compensation or extension of time claimed by the Contractor on account of any emergency actions or measures shall be submitted and determined as provided by Section 38.
- f. When necessary for the proper protection of the Work, temporary heating of a type compatible with the Work must be provided by the Contractor, at the Contractor's expense, unless otherwise specified.

**35. CLIMATIC CONDITIONS**

The Contractor shall suspend activity on and protect any portion of the Work that may be subject to damage by climatic conditions.

**36. PAYMENTS TO CONTRACTOR**

a. Unless otherwise provided in the Contract, the Owner will make partial payments to the Contractor on the basis of a duly certified and approved Schedule of Values and Certificate for Payment (CO-12), showing the estimate of the Work performed during the preceding calendar month or work period, as recommended by the A/E. When evaluating the Contractor's Certificate for Payment, the A/E will consider the value of the Work in place, the value of approved and properly stored materials, the status of the Work in relation to the Contract Completion Date, and the estimated value of the Work remaining to achieve Final Completion. The A/E will schedule a monthly pay meeting to occur no earlier than the 25th day of the month represented by the Certificate for Payment and no later than the 5th day of the following month. The Contractor shall submit its Certificate for Payment so that it is received by the A/E and the Owner's Project Manager at least one work day prior to the date scheduled by the A/E for the monthly pay meeting. The Owner will review the estimate with the A/E and the Contractor at the monthly pay meeting, which shall be considered the receipt date, and may approve to pay any or all of the Certificate for Payment. In preparing estimates, the material delivered to the Site and preparatory Work done shall be taken into consideration, if properly documented as required by Section 20 of these General Conditions, or as may be required by the A/E, so that actual quantities supplied or performed may be verified. Materials or equipment purchased specifically for the Project, but stored off the Site within the Commonwealth of Virginia, may be considered for payment provided all of the following are accomplished prior to the submission of the Certificate for Payment in which payment for such item is requested:

1. The Contractor must notify the Owner in writing, at least ten (10) Days prior to the submission of Certificate for Payment that specific items will be stored off-Site in a designated, secured place within the Commonwealth of Virginia. The Schedule of Values must be detailed to indicate separately both the value of the material and the labor/installation for trades requesting payment for stored materials. By giving such notification and by requesting payment for material stored off-Site, the Contractor warrants that the storage location is safe and suitable for the type of material stored and that the materials are identified as being the property of the Contractor, and agrees that loss of materials stored off the Site shall not relieve the Contractor of the obligation to timely furnish these materials for the Project and to achieve the Contract Completion Date. If the storage location is more than 20 miles from the Site, the Contractor may be required to reimburse the Owner for the cost incurred for travel to the storage location by Owner and/or the A/E to verify the Contractor's Certificate for Payment for materials stored off-Site. A supplementary agreement, acceptable to Owner, shall be required for payment for materials or equipment stored at a location that is not within the Commonwealth of Virginia.
2. Contractor's notification and Certificate of Payment regarding stored materials shall:
  - a. Itemize the quantity of such materials and document with invoices showing the cost of said materials;
  - b. Indicate the identification markings used on the materials, which shall clearly reference the materials as for the Project;
  - c. Identify the specific location of the materials, which must be within reasonable proximity to the Site and within the Commonwealth of Virginia;

- d. Include a letter from the Contractor's Surety which confirms that the Surety on the Performance Bond and the Labor and Material Payment Bond has been notified of the request for payment of materials stored off the Site and agrees that the materials are covered by the bonds; and
  - e. Include documentation establishing that the stored materials are covered by all-risk builder's risk insurance in an amount not less than the fair market value of the materials, which insurance shall include the Owner as an additional insured.
- 3. The A/E shall indicate, in writing, to the Owner that Submittals for materials stored off-Site have been reviewed and meet the requirements of the Contract Documents, that the stored materials meet the requirements of the Plans and Specifications, and that such materials conform to the approved Submittals. Should the A/E deem it necessary to visit the storage site to make such review, the Contractor shall bear the costs incurred therewith
- 4. The Owner, through the A/E, shall notify the Contractor in writing of its decision whether to pay for materials stored off-Site.
- 5. The Contractor shall notify the Owner in writing, through the A/E, when the materials are to be transferred to the Site and when the materials are received at the Site.
- b. Payment will not be made for materials or equipment stored on or off the Site which are not scheduled for incorporation into the Work within the six months next following submission of the Certificate for Payment without the prior written consent of the Owner, which consent may be withheld by the Owner if, in the Owner's sole discretion, it is not necessary to procure the materials more than six months in advance of use to assure their availability when needed.
- c. No payment shall be made to the Contractor until:
  - 1. The Contractor furnishes to the Owner its Social Security Number (SSN), if an individual, or its Federal Employer Identification Number (FEIN), if a proprietorship, partnership, corporation or other legal entity.
  - 2. Certificates of Insurance and required evidence of compliance by the Contractor with all the requirements of Section 11 and Section 12, if applicable, have been delivered to the Owner.
  - 3. Certificates of Insurance and required evidence of compliance by each Subcontractor with the requirements of Section 11 and Section 12, if applicable, have been delivered to the Owner for payments based on Work performed by a Subcontractor.
  - 4. The Contractor has: (i) submitted a preliminary schedule which is acceptable to the Owner in accordance with Section 19(a); (ii) submitted a fully complete Project schedule accepted by the Owner in accordance with Section 19(a); (iii) submitted all monthly Project reports required by Section 19(d); and (iv) timely provided a recovery schedule pursuant to Section 19(e), if requested by the Owner.
- d. The Owner shall withhold five percent (5%) of each progress payment to the Contractor until the Final Payment, unless otherwise provided by any law, regulation or program of the federal government. Such retainage shall be held to assure faithful performance of the Contract and may also be used as a fund to deduct amounts due to or claimed by the Owner, including, but not limited to, payment to the Owner of all moneys due for deductive change orders, credits, uncorrected Defective Work, interest, damages, and the like. (*Code of Virginia* § 2.2-4333). The Owner may, at its sole discretion, agree on an item by item basis to release the retainage on items which are fully 100% complete and which have been accepted by the Owner as being tested and

complete and on which no further action or work will be required. Retainage which is released by the Owner shall be distributed by the Contractor in conformance with Section 37.

- e. All material and Work for which progress payments are made shall thereupon become the sole property of the Owner, but this provision shall not relieve the Contractor from the sole responsibility for all materials and Work, including those for which payment has been made, or for the restoration of any damaged materials or Defective Work. No payment shall waive any right of the Owner to require Contractor to fulfill all of the terms and conditions of the Contract Documents
- f. The Final Payment, which shall include the retainage, less any amounts due to or claimed by the Owner, shall not become due until the A/E and the Owner agree that Final Completion has been achieved and until the Contractor shall deliver to the Owner through the A/E a Certificate of Completion by the Contractor (CO-13.2) and an Affidavit of Payment of Claims (CO-13), stating that all Subcontractors and Suppliers of either labor or materials have been paid all sums claimed by them for Work performed and materials furnished in connection with this Project less retainage. Amounts due the Owner which may be withheld from the Final Payment may include, but are not limited to, amounts due pursuant to Section 3(i), Section 16(a)-(d), Section 31(d), costs incurred to repair or replace Defective Work, costs incurred as a result of the Contractor's negligent acts or omissions or omissions of those for whom the Contractor is responsible, delay damages under Section 43(h), and any liquidated or actual damages.

If all Subcontractors and Suppliers of labor and materials have not been paid the full amount claimed by them, the Contractor shall list each to which an agreed amount of money is due or which has a claim in dispute. With respect to all such Subcontractors and Suppliers, the Contractor shall provide to the Owner, along with the Affidavit of Payment of Claims (CO-13), an affidavit from each such Subcontractor and Supplier stating the amount of their Subcontract or supply contract, the percentage of completion, the amounts paid to them by the Contractor and the dates of payment, the amount of money still due if any, any interest due the Subcontractor or Supplier, and whether satisfactory arrangements have been made for the payment of said amounts. If no agreement can be reached between the Contractor and one or more Subcontractors or Suppliers as to the amounts owed to the Subcontractors or Suppliers, the Owner may, in its discretion, interplead such portion of the moneys due to the Contractor which is claimed by the Subcontractor or Supplier into a Virginia Court or Federal Court sitting in Virginia, in the manner provided by law. Said interpleader and payment into court shall be deemed a payment to the Contractor. Nothing in this Section shall be construed as creating any obligation or contractual relationship between the Owner and any Subcontractor or Supplier, and the Owner shall not be liable to any Subcontractor or Supplier on account of any failure or delay of the Owner in complying with the terms hereof.

- g. Upon successful completion of the final inspection and all Work required by the Contract, including but not limited to the delivery of Record Drawings, equipment manuals, written warranties, acceptance of the Work by the Owner and the delivery of the affidavits required in Section 36(f), the A/E shall deliver the written Certificate of Completion by the A/E (CO-13.1) to the Owner, with a copy to the Contractor, stating the entire amount of Work performed and compensation earned by the Contractor. The Owner may accept the Work for occupancy or use while asserting claims against the Contractor, disputing the amount of compensation due to the Contractor, disputing the quality of the Work, disputing Final Completion, disputing Contractor's compliance with the Contract Documents, or any other reason.
- h. Unless there is a dispute about the compensation due to the Contractor, Defective Work, quality of the Work, compliance with the Contract Documents, Final Completion, claims by the Owner, other matters in contention between the parties, or unless monies are withheld pursuant to the Comptroller's Debt Setoff Program, within thirty (30) Days after receipt and acceptance of the Certificate for Payment in proper form by the A/E at the monthly pay meeting, the Owner shall pay to the Contractor the amount approved by the A/E, less all prior payments and advances

whatsoever to or for the account of the Contractor. In the case of Final Payment, the completed Affidavit of Payment of Claims (CO-13), the Certificate of Completion by the Contractor (CO-13.2) and the Certificate of Completion by the A/E (CO-13.1) shall accompany the final Certificate for Payment which is forwarded to the Owner for payment. The date on which payment is due shall be referred to as the Payment Date. Payment shall be mailed on or before the Payment Date for amounts and Work not in dispute, subject to any set offs claimed by the Owner; provided, however in instances where further appropriations are required by the General Assembly or where the issuance of further bonds is required, in which case, payment shall be made within thirty (30) Days after the effective date of such appropriation or within thirty (30) Days after the receipt of bond proceeds by the Owner. All prior estimates and payments, including those relating to extra Work, may be corrected and adjusted in any payment and shall be corrected and adjusted in the Final Payment. In the event that any Certificate for Payment contains a defect or impropriety, the Owner shall notify the Contractor of any defect or impropriety which would prevent payment by the Payment Date within five (5) Days after receipt of the Certificate for Payment by the Owner from the A/E.

- i. Interest shall accrue on all amounts owed by the Owner to the Contractor which remain unpaid seven (7) Days following the Payment Date. Said interest shall accrue at the discounted ninety-day U.S. Treasury bill rate as established by the Weekly Auction and as reported in the publication entitled The Wall Street Journal on the weekday following each such Weekly Auction. During the period of time when the amounts due to the Contractor remain unpaid following the seventh (7) Day after the Payment Date, the interest accruing shall fluctuate on a weekly basis and shall be that established by the immediately prior Weekly Auction. It shall be the responsibility of the Contractor to gather and substantiate the applicable weekly interest rates to the satisfaction of the Owner and to calculate to the satisfaction of the Owner the interest due. In no event shall the rate of interest charge exceed the rate of interest charged pursuant to *Code of Virginia* § 58.1-1812. No interest shall accrue on retainage or when payment is delayed because of a dispute or disagreement between the Owner and the Contractor regarding the quantity, quality or timeliness of the Work, including, but not limited to, compliance with Contract Documents or the accuracy of any Certificate for Payment. This exception to the accrual of interest stated in the preceding sentence shall apply only to that portion of a payment which is withheld and shall apply only for the duration of the dispute. Nothing contained herein shall be interpreted to prevent the withholding of retainage to assure faithful performance of the Contract. These same provisions relating to payment of interest to the Contractor shall apply also to the computation and accrual of interest on any amounts due from the Contractor to the Owner for deductive change orders and to amounts due on any claims by the Owner. The date of mailing of any payment by the U.S. Mail is deemed to be the date of payment to the addressee. No interest penalty shall be paid to any debtor on any payment, or portion thereof, withheld pursuant to the Comptroller's Debt Setoff Program, as authorized by the Virginia Debt Collection Act (§ [2.2-4800](#) *et seq.*), commencing with the date the payment is withheld. If, as a result of an error, a payment or portion thereof is withheld, and it is determined that at the time of setoff no debt was owed to the Commonwealth, then interest shall accrue at the rate specified above on amounts withheld that remain unpaid after seven Days following the Payment Date.
- j. The acceptance by the Contractor of the Final Payment shall be and operate as a release to the Owner of all claims by the Contractor, its Subcontractors and Suppliers, and of all liability to the Contractor whatever, including liability for all things done or furnished in connection with the Work, except for things done or furnished which are the subject of unresolved claims for which the Contractor has filed a timely written Notice of intent and all other Notices and documentation required by the Contract Documents and provided a claim is submitted no later than sixty (60) Days after Final Payment. Acceptance of any interest paid by the Contractor shall be a release of the Owner from claims by the Contractor for late payment.
- k. No Certificate for Payment authorized by the A/E, and no payment, final or otherwise, no certificate of completion, nor partial or entire use or occupancy of the Work by the Owner, shall be an acceptance of any Work or materials not in accordance with the Contract, nor shall the same

relieve the Contractor of responsibility for nonconforming materials or Defective Work, or operate to release the Contractor or its Surety from any obligation under the Contract, the Standard Performance Bond and the Standard Labor and Material Payment Bond.

**37. PAYMENTS BY CONTRACTOR (*Code of Virginia*, § 2.2-4354)**

Under *Code of Virginia* § 2.2-4354, the Contractor is obligated to:

- a. Within seven (7) Days after receipt of amounts paid to the Contractor by the Owner for Work performed by the Subcontractor or Supplier under this Contract, the Contractor shall:
  1. Pay the Subcontractor or Supplier for the proportionate share of the total payment received from the Owner attributable to the Work performed by the Subcontractor or the materials furnished by the Supplier under this Contract; or
  2. Notify the Owner and the Subcontractor or Supplier, in writing, of the Contractor's intention to withhold all or a part of the Subcontractor or Supplier's payment with the reason for nonpayment.
- b. The Contractor shall pay interest to its Subcontractor or Supplier on all amounts owed by the Contractor that remain unpaid after seven (7) Days following receipt by the Contractor of payment from the Owner for Work performed by the Subcontractor or materials furnished by the Supplier, except for amounts withheld as allowed under subsection (a) (2) of this Section. Unless otherwise provided under the terms of this contract, interest shall accrue at the rate of one percent per month.
- c. The Contractor shall include in each subcontract a provision requiring the Subcontractor to include in each of its subcontracts a provision requiring each of its subcontractors to include or otherwise be subject to the same payment and interest requirements with respect to each lower-tier subcontractor. Each Subcontractor shall include with its invoice to, or request for payment from, the Contractor, a certification that that Subcontractor has paid each of its suppliers and lower-tier subcontractors their proportionate share of previous payments received from the Contractor attributable to the Work performed or the materials furnished by it under this Contract.

The Contractor's obligation to pay interest to the Subcontractor or Supplier pursuant to subsection (b) of this Section is not an obligation of the Owner. A modification to this Contract shall not be made for the purpose of providing reimbursement for such interest charge. A Contractor's cost reimbursement claim shall not include any amount for reimbursement of any interest charge.

**38. CHANGES IN THE WORK**

- a. The Owner may at any time, by written order utilizing the Change Order (CO-11) and without Notice to the sureties, make changes in the Work which are within the general scope of the Contract, except that no change will be made which alone will increase the total Contract Price to an amount more than twenty percent (20%) in excess of the original Contract Price without Notice to sureties. At the time of the Preconstruction Meeting described in Section 50(b), the Contractor and the Owner shall advise each other in writing of their designees authorized to accept and/or approve Change Orders and of any limits to each designee's authority. Should any designee change or the limits of their authority change, the party initiating such change in designee or authority shall give written Notice to the other Party and the A/E within seven (7) Days. The Contractor agrees and understands that the authority of the Owner's designee is limited by *Code of Virginia*, § 2.2-4309 and any other applicable statute.

Change Orders shall be effective when signed by both parties, unless Governor approval (or by his or her designee) is required, in which event the Change Order shall be effective when signed by the Governor or his or her designee.

In any Change Order adjusting the Contract Price, the increase or decrease in the Contract Price shall be determined by one of the following methods as selected by the Owner:

1. **Fixed Price:** By a mutually agreed fixed amount adjustment to the Contract Price. The Change Order shall be substantiated by documentation from the Contractor itemizing the estimated quantities and costs of all labor, materials, and equipment required as well as any mark-up used. Any increase in the Contract Price shall include the Contractor's reasonable overhead and profit, including overhead for any unreasonable delay arising from or related to the Change Order and/or the change in the Work. See Subsections (d), (e) and (f), below.
2. **Unit Price:** By using unit prices and calculating the number of net units of Work in each part of the Work which is changed, either as the Work progresses or before Work on the change commences, and by then multiplying the calculated number of units by the applicable unit price set forth in the Contract or multiplying by a mutually agreed unit price if none was provided in the Contract. No additional percentage markup for overhead or profit shall be added to the unit prices.
3. **Cost Reimbursement:** The Owner may require the Contractor to perform change in the Work on a cost-reimbursement basis by issuing two Change Orders citing this Subsection: (a) an initiating Change Order, authorizing the changed Work; and (b) a confirming Change Order approving any adjustment in the Contract Price or the Contract Completion Date as a result of the change in the Work. The initiating Change Order shall:
  - a. Describe the scope or parameters of the change in the Work;
  - b. Describe the cost items to be itemized and verified for payment and the method of measuring the quantity of work performed;
  - c. Address the impact on the Critical Path and any adjustment to the Contract Completion Date;
  - d. Order the Contractor to proceed with the change to the Work;
  - e. Order the Contractor to keep in a form acceptable to the Owner, an accurate, itemized account of the actual cost of the change in the Work, including, but not limited to, the actual costs of labor, materials, equipment, and supplies;
  - f. Order the Contractor to annotate a copy of the Project schedule to accurately show the status of the Work at the time the initiating Change Order is issued, to show the start and finish dates of the changed Work, and the status of the Work when the changed Work is completed; and
  - g. State that a confirming Change Order will be issued to reflect any increase or decrease to the Contract Price and any change in the Contract Completion Date directly resulting from the change in the Work.

The Contractor shall sign the initiating Change Order acknowledging it will proceed with the change in the Work. The Contractor's signature on an initiating Change Order citing this Subsection 38(a)(3) shall not constitute the Contractor's agreement on the cost or time impact of the change in the Work.

Except as otherwise may be agreed to in writing by the Owner, costs incurred due to a change in the Work pursuant to this subsection 38(a)(3) shall not exceed those prevailing for the trades or crafts (based upon rates established by the U.S. Department of Labor,

Bureau of Labor Statistics, or other generally recognized cost data publication), materials, and equipment in the locality of the Project, may include only those items listed as allowable in Subsection 38(e), and shall not include any of the costs listed as not allowable in Subsection 38(f). The Owner shall be permitted, on a daily basis, to verify the Contractor's cost records and may require such additional records as are necessary to determine the cost of the change to the Work.

Within fourteen (14) Days after the completion of the change in the Work, the Contractor and the Owner shall review and reconcile all cost records and schedule information regarding the change in the Work. The parties shall prepare a confirming Change Order addressing: (i) any change in the Contract Price resulting from the change in the Work, based on the records kept and the Contractor's allowance for overhead and profit determined in accordance with the provisions set forth in Subsections 38(d), (e), and (f) below; and (ii) any change in the Contract Completion Date as a result of the change in the Work's impact on the Critical Path. If agreement on the confirming Change Order is not reached within the fourteen (14) Day period following completion of the change in the Work, the Contractor may submit a claim for the disputed cost or time as provided for in Section 47.

4. The Owner may issue a unilateral Change Order for any change in the Work stating the change in the Contract Price and/or change in the Contract Completion Date deemed appropriate by the Owner for the Work. If the Contractor objects to adjustments reflected in the unilateral Change Order, the Contractor may submit a claim for the disputed costs or time as provided for in Section 47.
- b. The Contractor shall review any Owner proposed change in the Work and shall respond in writing within fourteen (14) calendar Days after receipt of the proposed change (or such other reasonable time as the Owner may direct), stating the effect of the proposed change upon its Work, including any increase or decrease in the Contract Price or Contract Completion Date that the Contractor requests as a result of the proposed change. The Contractor shall furnish to the Owner an itemized breakdown of the quantities and prices used in computing the proposed change in Contract Price. Any change in the Contract Completion Date shall be justified as set forth in Subsection 38(g).

The Owner shall review the Contractor's proposal and respond to the Contractor within thirty (30) days of receipt. If a change to the Contract Price and Contract Completion Date are agreed upon, both parties shall sign the Change Order. If a revised Contract Price and/or Contract Completion Date are not agreed upon, the Owner may direct the Contractor to proceed pursuant to Subsections 38(a)(3) or 38(a)(4).

- c. In figuring changes, any instructions for measurement of quantities set forth in the Contract shall be followed.
- d. Overhead and profit for both additive and deductive changes in the Work (other than changes covered by unit prices) shall be paid by applying the specified percentage markups only on the net cost of the changed Work (i.e. difference in cost between original and changed Work excluding overhead and profit). Said percentages for overhead and profit shall reasonably approximate the Contractor's overhead and profit, but shall not exceed the percentages for each category listed below:
  1. If a Subcontractor does all or part of the changed Work, the Subcontractor's mark-up for overhead and profit on the Work it performs shall be a maximum of fifteen percent (15%). The Contractor's mark-up for overhead and profit on the Subcontractor's price shall be a maximum of ten percent (10%).
  2. If the Contractor does all or part of the changed Work, its markup for overhead and profit on the changed Work it performs shall be a maximum of fifteen percent (15%).

3. If a Sub-subcontractor at any tier does all or part of the changed Work, the Sub-subcontractor's markup on that Work shall be a maximum of fifteen percent (15%). The markup for overhead and profit on a Sub-subcontractor's Work by the Contractor and all intervening tiers of Subcontractors shall not exceed a total of ten percent (10%).
  4. Where Work is deleted from the Contract prior to commencement of that Work without substitution of other similar Work, one hundred percent (100%) of the Contract Price attributable to that Work shall be deducted from the Contract Price. However, in the event that equipment, product or material Submittals have been approved and orders placed for said equipment, products or materials, a lesser amount, but in no case less than eighty percent (80%) of the Contract Price attributable to that Work, shall be deducted from the Contract Price. The credit to the Owner for reduced premiums on Standard Labor and Material Payment Bonds and Standard Performance Bonds shall in all cases be one hundred percent (100%).
- e. Allowable costs for changes in the Work may include but are not limited to the following:
1. Labor costs for employees directly employed in the change in the Work, including salaries and wages plus the cost of payroll charges and fringe benefits and overtime premiums, if such premiums are explicitly authorized by the Owner.
  2. Materials incorporated into the change to the Work, including costs of transportation and storage, if applicable. If applicable, all cash discounts shall accrue to the Contractor, unless the Owner deposits funds with the Contractor to make such payments. All trade discounts, rebates, refunds, and returns from the sale of surplus materials shall accrue to the Owner.
  3. Equipment incorporated in the changed Work or equipment used directly in accomplishing the Work. If rented expressly for accomplishing the change in the Work, the cost shall be the rental rate according to the terms of the rental agreement, which the Owner shall have the right to approve. If owned by the Contractor, the costs shall be a reasonable price based upon the life expectancy of the equipment and the purchase price of the equipment. If applicable, transportation costs may be included.
  4. Costs of increases in premiums for the Standard Labor and Material Payment Bond and the Standard Performance Bond, provided coverage for the cost of the change in the Work results in such increased costs. At the Owner's request, the Contractor shall provide proof of his notification to the Surety of the change in the Work and of the Surety's agreement to include such change in its coverage. The cost of the increase in premium shall be an allowable cost but shall not be marked up.
  5. Contractor and Subcontractor overhead costs as set forth in Subsection (d) markups above.
  6. **Agreed Compensation for Overhead for Changes to Time for Completion or Contract Completion Date for Changes to the Work:** If the change in the Work also changes the Contract Completion Date by adding Days to complete the Work, an itemized accounting of the following direct Site overhead and home office overhead and other indirect overhead expenses set forth in subparagraphs (a) and (b) below may be considered as allowable costs for compensation in addition to those shown above:
    - a. **Direct Site Overhead Expenses:** The Contractor's per diem expenses, as shown by the itemized accounting, for the following allowable direct Site overhead expenses: The Site superintendent's pro-rata salary, temporary Site office trailer, and temporary Site utilities including basic telephone service,

electricity, heat, water, and sanitary / toilet facilities for each Day added. All other direct expenses are covered by and included in the Subsection 38(d) markups above.

- b. **Home Office and Other Indirect Overhead Expenses:** A five percent (5%) markup on the above direct Site overhead expenses will be allowed as compensation for the Contractor's home office overhead and all other direct or indirect overhead expenses for Days added to the Time for Completion or the Contract Completion Date for a change in the Work. All other overhead and other direct or indirect overhead expenses are covered by and included in this markup and the Subsection (d) markups above.

No direct Site, home office, or other indirect overhead shall be paid if the changed Work is done on a unit price basis unless the Contractor can demonstrate that the unit price does not include direct and indirect overhead costs.

7. Any other costs directly attributable to the change in the Work with the exception of those set forth in Subsection 38(f) below.

- f. Allowable costs for changes in the Work shall not include the following:

1. Costs due to the negligence of the Contractor, any Subcontractor, Supplier, their employees, or other persons for whom the Contractor is responsible, including, but not limited to, costs for the correction of Defective Work, for improper disposal of material, for equipment wrongly supplied, for delay in performing the Work, or for delay in obtaining materials or equipment.
2. Home office expenses including payroll costs for the Contractor's officers, executives, administrators, accountants, counsel, timekeepers, clerks, and other similar administrative personnel employed by the Contractor, whether at the Site or in the Contractor's principal or branch office for general administration of the Work. These costs are deemed overhead included in the percentage markups allowable in Subsections 38(d) above.
3. Home and field office expenses not itemized in Subsection 38(e) (6) above. Such items include, but are not limited to, expenses of Contractor's home and branch offices, Contractor's capital expenses, interest on Contractor's capital used for the Work, charges for delinquent payments, small tools, incidental job costs, rent, utilities, telephone and office equipment, and other general overhead expenses.
4. Other items reasonably determined by the Owner to not be allowed.

- g. All Change Orders, except initiating Change Orders authorizing work pursuant to Subsection 38(a)(3) procedures, must state that the Contract Completion Date is not changed or is either increased or decreased by a specific number of Days. The old Time for Completion and, if changed, the new Time for Completion also must be stated.

If the Contractor requests an extension to the Contract Completion Date, it must provide written justification for the extension to the A/E and to the Owner. No extension to the Contract Completion Date shall be allowed unless, and then only to the extent that, the additional or changed Work increases the length of the Critical Path beyond the Contract Completion Date. Extensions to the Contract Completion Date will be granted only when an excusable delay exceeds the Total Float in the activity or path of activities affected by the Change Order. If approved, the increase in time required to complete the Work shall be added to the Contract Completion Date.

The Owner may decrease, by Change Order, the Contract Completion Date when an Owner-requested deletion from the Work results in a decrease in the actual time required to achieve

Substantial Completion of the Work. The Contractor may submit a request for an earlier Contract Completion Date under the procedures and subject to the considerations set forth in Section 19(f). No request for an earlier Contract Completion Date shall be considered for approval unless the proposed shorter schedule is otherwise acceptable under Sections 19(b) or (c), whichever is applicable.

With the exception of Change Orders under Subsection 38(a) (3), which shall arrive at a change to the Contract Price and Contract Completion Date using the procedures set forth therein, each Change Order shall include all time and monetary impacts of the change, whether the Change Order is considered alone or with all other changes during the course of the Project. Change Orders issued without a change to the Contract Completion Date and/or Contract Price conclusively establish that the change in the Work reflected by that Change Order had no impact on the Contract Price and/or Contract Completion Date. The parties may mutually agree in writing to postpone a determination of the time-related impacts of a change in the Work for a period of not more than forty-five (45) Days following completion of the change in the Work to give the Contractor an opportunity to submit documentation substantiating any requested change in the Contract Completion Date or Contract Price. During any such postponement, all Work shall proceed, unless the Owner agrees otherwise. The Contractor's failure to submit all required substantiating documentation during a forty-five (45) Day postponement shall conclusively establish that the change in the Work did not impact nor require an adjustment of the Contract Price and Contract Completion Date.

If at any time there is a delay in the Critical Path of the Work due to a postponement, the Contractor's efforts to justify an extension of the Contract Completion Date or an increase in the Contract Price, or the Contractor's refusal to proceed with any of the Work, such delay and any Contractor costs resulting from it shall not serve as the basis for the extension of the Contract Completion Date or for an increase in the Contract Price.

- h. The acceptance by the Contractor of any payment made by the Owner under a Change Order shall be and operate as a release to the Owner of all demands and claims by the Contractor to additional compensation or an adjustment of the Contract Price or Contract Completion Date for all things done or furnished in connection with the Work described in the Change Order. The execution of any Change Order by the Owner shall not be an acceptance of any Work or materials not in accordance with the Contract Documents, nor shall it relieve the Contractor of responsibility for faulty materials, Defective Work or poor workmanship or operate to release the Contractor or its surety from any obligation arising under the Contract, the Standard Performance Bond, or the Standard Labor and Material Payment Bond.
- i. Payments will not be made for any Work, labor, or materials performed on a unit price or a Subsection 38(a)(3) basis until the Contractor has furnished the Owner documents, certified as true and correct by an authorized officer or agent of the Contractor, evidencing the cost of such Work, labor, and materials. The Owner may require any or all of the following documentation to be provided by the Contractor.

**For Work performed on a Unit Price basis:**

- 1. Certified measurements of authorized and approved excavations, over-excavations, fills and/or backfills, and similar work; and/or
- 2. Certified measurements of piling installed, caissons installed, and similar work; and/or
- 3. Daily records of waste materials removed from the Site and/or fill materials imported to the Site.
- 4. Other measurements as appropriate to establish the actual quantities of work being performed on a Unit Price basis.

**For Work performed on a Subsection 38(a)(3) basis:**

1. Certified payroll records showing the name, classification, date, daily hours, total hours, rate, and extension for each laborer, foreman, supervisor, or other worker;
2. Equipment type & model, dates, daily hours, total hours, rental rate, or other specified rate and extension for each unit of equipment;
3. Invoices for materials showing quantities, prices, and extensions;
4. Daily records of waste materials removed from the Site and/or fill materials imported to the Site;
5. Certified measurements of over-excavations, piling installed and similar work;
6. Transportation records for materials, including prices, loads, and extensions.

Requests for payment shall be accompanied and supported by invoices for all materials used and for all transportation charges claimed. If materials come from the Contractor's own stock, then an affidavit may be furnished, in lieu of invoices, certifying quantities, prices, etc. to support the actual cost.

**39. EXTRAS**

If the Contractor claims that any instructions given to him by the A/E or by the Owner, by drawings or otherwise, require extra work outside the scope of the Contract, then, except in emergencies endangering life or property, he shall give the A/E and the Owner written Notice thereof before proceeding to execute the extra work. Said Notice shall be given promptly enough to avoid delaying the Work and in no instance later than fourteen (14) Days after the receipt of such instructions. If it is not immediately clear to the Contractor that a request or instruction involves extra Work outside the scope of the Contract, then written Notice shall be sufficient if it's given as soon as possible after Contractor's realization that a request or instruction involves extra Work, but in no event later than fourteen (14) Days after the start of such extra Work. If the Owner agrees, a Change Order shall be issued as provided in Section 38 for the extra work and any additional compensation shall be determined by one of the methods provided in Subsection 38(a), as selected by the Owner. If the Owner does not agree, then the Contractor may submit a claim for the disputed cost or time as provided for in Section 47. No claim for additional compensation for extra work will be considered unless the Contractor timely has provided the required Notice.

**40. CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE THE CONTRACT**

If the Work should be stopped under an order of any court or other public authority for a period of ninety (90) Days through no fault of the Contractor or anyone employed by it, or if the Owner should fail to pay to the Contractor within thirty (30) Days any sum certified by the A/E when no dispute exists as to the sum due or any requirement of the Contract, then the Contractor may, upon ten (10) Days written Notice to the Owner and the A/E, stop Work or terminate the Contract and recover from the Owner payment for the cost of the Work actually performed, together with overhead and profit thereon, but profit on the Work performed shall be recovered only to the extent that the Contractor can demonstrate that it would have had profit on the entire Contract if it had completed the Work. The Contractor may not receive profit or any other type of compensation for parts of the Work not performed. The Contractor may recover the reasonable cost of physically closing down the Site, but no other costs of termination. The Owner may offset any claims it may have against the Contractor against the amounts due to the Contractor. In no event shall termination of the Contract by the Contractor terminate the obligations of the Contractor's surety on its payment and performance bonds.

**41. OWNER'S RIGHT TO TERMINATE THE CONTRACT FOR CAUSE**

- a. If the Contractor should be adjudged as bankrupt, or if it should make a general assignment for the benefit of its creditors, or if a receiver should be appointed on account of its insolvency, the Owner may terminate the Contract. If the Contractor should refuse or should repeatedly fail, except in cases for which extension of time is provided, to supply enough properly skilled tradespeople or laborers or proper materials and equipment, or if it should fail to perform the Work in a diligent, efficient, workmanlike, skillful, or careful manner, or if it should fail or refuse to perform the Work in accordance with the Contract Documents, or if it should fail to make prompt payment to Subcontractors or Suppliers of material or labor, or if it should disregard laws, ordinances, building codes or the written instructions of the A/E or the Owner, or otherwise be in substantial, willful or repeated violation of any provision of the Contract, then the Owner may terminate the Contract.
- b. Prior to termination of the Contract, the Owner shall give the Contractor and its surety ten (10) Days' Notice of such termination and allow ten (10) Days during which the Contractor and/or its surety may rectify the basis for the Notice. If rectified to the satisfaction of the Owner within said ten (10) Days, the Owner may rescind its notice of termination. If the basis for the termination is not rectified within said ten (10) Days, the termination for cause shall become effective at the end of the ten (10) Day period without further Notice to the Contractor. At any time, the Owner may, in writing, postpone the effective date of the termination for cause, at its sole discretion, if it should receive reassurances from the Contractor and/or its surety that the basis for the termination will be remedied in a time and manner which the Owner finds acceptable. If at any time after such a postponement, the Owner determines that Contractor and/or its surety has not or is not likely to rectify the causes of termination in an acceptable manner or to do so within the time allowed, then the Owner may immediately terminate the Contract for cause, without the necessity of further ten (10) Day Notice, by notifying the Contractor and its surety in writing of the termination. In no event shall termination for cause terminate the obligations of the Contractor's surety on its payment and performance bonds.
- c. Upon termination of the Contract becoming effective, the Owner shall take possession of the Site and of all materials, tools and equipment thereon and shall proceed as follows:
  1. **No Security or Bonds Provided:** If no security has been required pursuant to Section 8, the Owner shall finish the Work by whatever method the Owner deems reasonable or expedient. If the expense of finishing the Work, including compensation for additional managerial and administrative services, shall exceed the unpaid balance of the Contract Price, the Contractor shall pay the difference to the Owner, together with any other expenses of terminating the Contract and having it completed by others.
  2. **Security or Bonds Provided:** If security has been required and provided pursuant to Section 8 herein, the Owner shall provide Notice to the Surety that termination of the Contract became effective and proceed as set forth in the Standard Performance Bond (CO-10), and the Terms and Conditions therein. If the expense of finishing the Work, including compensation for additional managerial and administrative services, shall exceed the unpaid balance of the Contract Price and all amounts due under the Standard Performance Bond, the Contractor shall pay the difference to the Owner, together with any other expenses of terminating the Contract and having it completed by others.
- d. If it should be judicially determined that the Owner improperly terminated this Contract for cause, then the termination shall be deemed to be a termination for the convenience of the Owner and the Contractor's rights and remedies shall be solely limited to those provided by Section 42 of these General Conditions.
- e. Termination of the Contract for cause is in addition to and without prejudice to any other right or remedy of the Owner. Any actions by the Owner permitted herein shall not be deemed a waiver of

any other right or remedy of the Owner under the Contract or under the law. The Owner may offset any claims it may have against the Contractor against the amounts due to the Contractor. The provisions of this Section shall survive termination of the Contract.

- f. The provisions of Sections 3(j), 9(e), 14, 30 and 45 also shall survive termination of the Contract for cause.

#### 42. TERMINATION BY OWNER FOR CONVENIENCE

- a. The Owner may terminate this Contract, in whole or in part, at any time without cause upon giving the Contractor written Notice of such termination. Upon Notice of termination for convenience, the Contractor shall immediately cease Work and remove from the Site all of its labor forces, equipment and such of its materials as Owner elects not to purchase or to assume in the manner hereinafter provided. The Contractor also shall take such steps as Owner may require to assign to the Owner the Contractor's interest in all Subcontracts and purchase orders designated by Owner. After all such steps have been taken to Owner's satisfaction, the Contractor shall receive as full compensation the following:
  - 1. Amounts due for Work performed in accordance with the Contract subsequent to the latest approved Schedule of Values and Certificate for Payment (CO-12) through the date of termination; and
  - 2. All amounts due under Contract for Work completed prior to the date of termination; and
  - 3. Reasonable compensation for the actual cost of demobilization incurred by the Contractor as a direct result of termination for convenience, plus overhead not to exceed 15 percent (15%) of the direct costs of demobilization.

The Contractor agrees it shall not be entitled to any additional compensation, including but not limited to loss of revenue, income, profit, business, reputation, or bonding capacity, consequential damages or lost profits, but shall only receive payment upon termination for convenience as stated in this Subsection 42(a). The Owner may offset any claims it may have against the Contractor against the amounts due to the Contractor. Upon payment of the amounts stated in this Subsection 42(a), Owner shall have no further obligations to Contractor of any nature.

- b. In no event shall termination for the convenience of the Owner terminate the obligations of the Contractor's surety on the payment and performance bonds. The provisions of Sections 3(j), 9(e), 14, 30 and 45 also shall survive termination of the Contract for convenience.
- c. Any actions by the Owner permitted herein shall not be deemed a waiver of any other right or remedy of the Owner under the Contract or under the law. The provisions of this Section shall survive termination of the Contract.

#### 43. DAMAGES FOR DELAYS; EXTENSION OF TIME

- a. **Excusable Non-Compensable Delays:** If the Critical Path is delayed by strikes, fires, unusual delays in transportation, unavoidable casualties, or other causes outside the control of the Owner and the Contractor, with the exception of delays caused by weather which are addressed in Section 6, and the Contractor seeks an extension of the Contract Completion Date, then the Contractor shall give the Owner and A/E written Notice of the delay not later than fourteen (14) Days following the inception of the delay. The Contractor shall give written Notice to the Owner and A/E of the termination of the delay event not later than fourteen (14) Days after the delay has ceased. Within twenty (20) Days after the delay event has ceased, Contractor shall submit to the Owner and the A/E, the Contractors' written request for an extension of the Contract Completion Date, specifically stating the cause of the delay, the number of days of extension requested, and an analysis of the delay event's impact on the Critical Path. If the Owner agrees that the Critical Path

has been impacted by the delay event, the Owner shall extend the Contract Completion Date for the length of time that the Critical Path was delayed. The Contractor shall not be charged with liquidated or actual damages for such period of Critical Path delay nor shall the Contractor be due compensation or damages of any kind, under any theory of law, as a result of such Critical Path delay, the impact of such delay, or its acceleration of Work as a result of such delay.

- b. **Excusable Compensable Delays:** If the Critical Path unreasonably is delayed by acts or omissions of the Owner, or its agents, contractors, or employees due to causes within the Owner's control, and the Contractor seeks an extension of the Contract Completion Date and/or additional compensation due to the unreasonable delay, then the Contractor shall notify the Owner and the A/E immediately at the time of the occurrence giving rise to the delay by the fastest means available. The Contractors also shall give written Notice to the Owner and A/E no later than two (2) business days after inception of the delay. The Contractor's written Notice shall specify the nature of the delay claimed by the Contractor, the cause of the delay, and the impact of the delay on the Critical Path. The Owner shall have three (3) business days to respond to the Contractor's Notice with a resolution, remedy, direction to alleviate the delay, or rejection of the Contractor's requested relief. The Owner's failure to respond within the time required shall be deemed to be a denial of the Contractor's entitlement to an extension of the Contract Completion Date and additional compensation. The Contractor shall also give written Notice to the Owner and A/E of the termination of the delay event not later than fourteen (14) Days after the delay has ceased. Within twenty (20) Days after the delay event has ceased, Contractor shall submit to the Owner and the A/E, the Contractor's written request for an extension of the Contract Completion Date, specifically stating the cause of the delay, the number of days of extension requested, a calculation of the additional compensation sought, and an analysis of the delay event's impact on the Critical Path. Requests for additional compensation must be substantiated by itemized data and records demonstrating that the costs incurred by the Contractor are directly attributable to the delay and shall be calculated from the Contract Completion Date, not using any early completion planned or scheduled by the Contractor unless a Change Order has been executed pursuant to Section 19(f) changing the Contract Completion Date to reflect such early completion. If and to the extent that a delay is caused by or due to the Owner or A/E taking any actions permitted or required by the Contract, the Contractor shall be entitled to an extension of the Contract Completion Date or additional compensation only for the portion of the delay that is unreasonable, if any.
- c. **Non-Excusable Non-Compensable Delays:** The Contractor shall not be entitled to an extension of the Contract Completion Date or to any additional compensation if and to the extent a delay is: (1) caused by acts, omissions, fault, or negligence of the Contractor or its Subcontractors, agents or employees; (2) arises from foreseeable causes within the control of the Contractor or its Subcontractors, agents or employees, including, but not limited to, Defective Work, poor workmanship, improper or inferior materials, Defective Work which must be corrected before dependent work can proceed, Defective Work for which corrective action must be determined before like work can proceed, from incomplete, incorrect, or unacceptable Submittals or samples, or the failure to furnish enough or properly skilled workers, proper materials or necessary equipment to perform the work in a timely manner in accordance with the Project schedule; or (3) due to causes that would entitle the Owner to recover delay costs or other damages from Contractor.
- d. No extension of time or additional compensation will be allowed unless the Contractor demonstrates that the delay directly impacted the Critical Path of the most current approved Project schedule and that all Float has been consumed. No extension of time or additional compensation will be allowed if the Contractor failed to provide all Notice and information in the manner and within the time periods set forth in Subsections 43(a) or (b) above, whichever applies. Failure to timely provide all required information and Notices shall preclude an extension of the Contract Completion Date or payment of additional compensation based upon that cause.
- e. If the Contractor makes a claim against the Owner for costs or damages, the Contractor shall be liable to and shall pay to the Owner that percentage of all costs incurred by the Owner in

investigating, analyzing, negotiating, and litigating or arbitrating that percentage of the claim which is determined through litigation or arbitration to be false or to have no basis in law or in fact. (*Code of Virginia*, § 2.2-4335).

- f. Any change in the Time for Completion or Contract Completion Date shall be accomplished only by issuance of a Change Order.
- g. **Agreed Compensation/Liquidated Damages for Contractor Delay:** If liquidated damages are not established in the Supplemental General Conditions, the Contractor shall be liable for any and all actual damages sustained by Owner as a result of a delay for which Contractor is responsible. In addition to damages for delay, whether liquidated or actual, the Contractor shall also be liable for any and all actual damages sustained by the Owner as a result of any other breach of the Contract, including, but not limited to, Defective Work or abandonment of the Contract.

#### 44. INSPECTION FOR SUBSTANTIAL COMPLETION & FINAL COMPLETION

- a. The Contractor shall advise the Owner using the Certificate of Partial or Substantial Completion by the Contractor (CO-13.2a) of the date when the Work or designated portion thereof will be substantially complete and ready for inspection and testing by Owner to determine if Substantial Completion has been achieved. Contractor shall deliver Form CO-13.2a to the A/E at least ten (10) Days in advance of the date identified on the Form CO-13.2a. The A/E shall then attach his or her written endorsement as to whether the Work will be ready for inspection and testing on the date identified on the Form CO-13.2a. The A/E's endorsement is a convenience to the Owner only and shall not relieve the Contractor of its responsibility nor shall the A/E's endorsement be deemed to evidence or establish that the Work was substantially complete or ready for inspection and testing. Inspection and testing shall take place at a time(s) mutually agreeable to the Contractor, Owner, A/E, and Building Official.

The inspection shall include a demonstration by the Contractor that all equipment, systems and operable components of the Project function properly and in accordance with the Contract Documents. The Contractor shall furnish access for the inspection and testing as provided in Section 21 of these General Conditions. The inspection and testing shall determine whether Substantial Completion has been accomplished and shall result in a written list of unfinished Work and Defective Work, commonly referred to as a "punch list", which must be completed and corrected prior to Final Completion.

If, after successful completion of all testing, the Architect/ Engineer determines that the Work, either in whole or in part, has achieved Substantial Completion, the A/E shall notify the Owner of such, in writing, using the Certificate of Partial or Substantial Completion by the A/E (CO-13.1a).

The Owner shall notify the Contractor, in writing, of the date the Owner accepts the Work, or the specified portion thereof, as having achieved Substantial Completion or, if it is not, shall notify the Contractor of the deficiencies to be corrected or completed before such Work will be accepted as substantially complete.

- b. The Contractor shall advise the Owner, in writing using the Certificate of Completion by the Contractor (CO-13.2) of the date when the Work has reached or will reach Final Completion and will be ready for final inspection and testing. Contractor shall deliver Form CO-13.2 to the A/E at least five (5) Days in advance of the date identified on the Form CO-13.2. The A/E shall then attach his or her written endorsement as to whether the Work will be ready for inspection and testing on the date identified on Form CO-13.2. The A/E's endorsement is a convenience to the Owner only and shall not relieve the Contractor of its responsibility nor shall the A/E's endorsement be deemed to evidence or establish that the Work achieved Final Completion. Final Completion inspection and any necessary testing shall be conducted in the same manner as the inspection for Substantial Completion. The Owner shall not establish the Final Completion Date until the Work is finally and totally complete, including the completion of punch list items,

submission of all required documentation, and elimination and correction of all Defective Work.

- c. Representatives of the Contractor, Owner, A/E, and Building Official will participate in the Substantial Completion and/or Final Completion inspections. The A/E shall conduct and document the inspections. The Owner may elect to have other persons of its choosing also participate in the inspections. If one or more Substantial or Final Completion re-inspections are required, the Contractor shall reimburse the Owner for all costs of re-inspection or, at the Owner's option, the costs may be deducted from payments due to the Contractor.
- d. A representative of the State Fire Marshal's Office will either be present at the Substantial and Final Completion inspections or otherwise inspect the completed Work and report any fire safety deficiencies to the Building Official. The State Fire Marshal will advise the Owner and Contractor of those deficiencies.
- e. Approval of Work at or as a result of any inspection required herein shall not release the Contractor or its surety from responsibility for complying with the Contract.

#### **45. GUARANTEE OF WORK AND INDEMNIFICATION**

- a. Except as otherwise specified or required, the Contractor guarantees all Work, materials, equipment, and workmanship conform to the requirements of the Contract Documents and are free from defects, imperfections, or non-conformities, normal wear and tear excepted, for a period of one (1) year from the Final Completion Date. Equipment and facilities which have seasonal limitations on their operation (e.g. heating or air conditioning units) shall be guaranteed for one (1) full year from the date of the equipment's first seasonally appropriate test and acceptance, in writing, by the Owner. Where the Owner agrees to take Beneficial Occupancy of a portion or phase of the Work which has been determined to be substantially complete before the entire Work achieves Final Completion, the guarantee for that portion or phase shall begin on the date that the Owner takes Beneficial Occupancy, unless otherwise specified in the Supplemental General Conditions, Special Conditions, or by separate agreement. This guarantee is separate and apart from any manufacturers' warranties and the warranty set forth in Section 30. At six (6) months and eleven (11) months after Substantial Completion, the Contractor shall meet with the Owner to review the status of and assign value to any unresolved warranty, guarantee, and punch list items.
- b. If, within any guarantee period, Work which is not in accordance with the Contract, Defective Work, or inferior material, equipment or workmanship is noted by the Owner or A/E which requires or renders necessary repairs or changes in connection with the guaranteed Work, the Contractor shall, promptly upon receipt of Notice from the Owner, such Notice being given not later than two weeks after the guarantee period expires, and without expense to the Owner:
  - 1. Correct, repair, replace or otherwise place in satisfactory condition all Defective Work, defects, nonconformity, inferior materials, equipment or workmanship;
  - 2. Make good all damage to the structure or Site or equipment or contents thereof, which, in the opinion of the Owner or the A/E, is the result of the use of materials, equipment or workmanship which are inferior, defective or not in accordance with the requirements of the Contract; and
  - 3. Make good any Work or materials or the equipment and contents of structures and/or Site disturbance that results from fulfilling the requirements of the guarantee.
- c. In any case when in fulfilling the requirements of the Contract and this guarantee or any other guarantee or warranty the Contractor disturbs any work performed by a separate contractor, the Contractor shall restore such work to a condition satisfactory to the A/E and Owner and guarantee such restored work to the same extent as if it was guaranteed under this Contract.

- d. If the Contractor, after Notice, fails to proceed promptly to comply with the obligations of this Section 45, and the surety, after Notice, fails to cure the Contractor's default as provided in Section 41, the Owner may undertake all needed corrections or repairs and the Contractor and its surety shall be liable for all expenses incurred.
- e. All special warranties and guarantees applicable to definite parts of the Work that may be stipulated in or required by the Contract Documents shall be subject to the terms of this Section during the first year of such special warranty or guarantee. The guarantee of this Section shall be in addition to and not in lieu of all other warranties, express or implied, applicable to or arising from this Contract or by law.
- f. Nothing contained in this Section shall be construed to establish a period of limitation with respect to any other obligation which the Contractor might have under the Contract Documents, including liability for Defective Work under Section 30, for indemnity or for breach of the Contract. This Section relates only to the specific obligation of the Contractor to correct the Work and does not limit the time within which its obligation to comply with the Contract Documents otherwise may be enforced, nor the time within which legal proceedings may be commenced to establish the Contractor's liability with respect to its obligations under the Contract Documents.
- g. In the event the Work of the Contractor is to be modified by another contractor, either before or after the Final Inspection, the Contractor shall remain responsible in all respects under this Section's Guarantee of Work and under any other warranties or guarantees, express or implied, applicable to or arising from this Contract or by law. However, the Contractor shall not be responsible for any defects in material or workmanship introduced by another Contractor modifying Contractor's Work. The Contractor and any contractor making modifications shall each be solely responsible for its respective work. A contractor modifying the Contractor's Work shall be responsible for any damage to or defect introduced into the Work by its modification.

If Contractor claims that a subsequent contractor has introduced defects of materials and/or workmanship into its Work, Contractor shall demonstrate clearly the nature and extent of such introduced defects and the other contractor's responsibility for those defects. Any contractor modifying the work of another shall have the same burden if it asserts that defects in its work were caused by the contractor whose work is modified.
- h. The Contractor shall indemnify and hold harmless the Commonwealth of Virginia, the Owner and the Owner's consultants, representatives, agents and employees from and against any and all claims, causes of action, losses, costs, expenses or damages, including but not limited to attorney's fees, of any kind or nature whatsoever, arising from or relating to any bodily injury, including sickness, disease or death, any property damage, and any monetary loss, that results from or arises out of the Work performed by the Contractor, or by or in consequence of the Contractor's neglect in safeguarding the Work, its use of unacceptable materials in the Work, or resulting from any act, omission, negligence, or misconduct of the Contractor, any of its subcontractors, anyone directly or indirectly employed by them or anyone for whose acts the Contractor is or may be liable. The Owner may retain as much of the monies due the Contractor under the Contract as the Owner considers necessary to ensure that a fund will be available to pay a settlement or judgment of such suits, actions, or claims. If insufficient monies are or will become due, the Contractor's surety and/or insurers will not be released from liability until all such claims and actions have been settled and suitable evidence to that effect has been furnished the Owner.

#### 46. ASSIGNMENTS

Neither party to the Contract shall assign the Contract in whole or any part without the written consent of the other, nor shall the Contractor assign any monies due or to become due to him hereunder, without the prior written consent of the Owner. Consent to assignment shall not be unreasonably withheld. No assignment shall relieve any party from its obligations under the Contract.

**47. CONTRACTUAL DISPUTES (*Code of Virginia*, § 2.2-4363)**

- a. Contractual claims, whether for money or for other relief, shall be submitted, in writing, no later than sixty (60) Days after Final Payment; however, written Notice of the Contractor's intention to file such claim must be given to the Owner within fourteen (14) Days of the time of the occurrence or beginning of the Work upon which the claim is based. Such Notice shall state that it is a "notice of intent to file a claim" and include a written statement describing the act or omission of the Owner or its agents that allegedly caused or may cause damage to the Contractor and the nature of the claimed damage. Verbal notice, the Owner's actual knowledge, or a written notice given more than fourteen (14) Days after the occurrence or beginning of the Work upon which the claim is based, shall not be sufficient to satisfy the requirements of this Section. All claims shall state that they are "claims" pursuant to this Section, be submitted along with all practically available supporting evidence and documentation and the certification required by Subsection 47(f), and request a final decision. Certificates for payment, applications for payment, vouchers, invoices and similar requests for payment submitted for work done by the Contractor in accordance with the expected contract performance are routine submissions and are not claims under this Section. Proposed or requested Change Orders, demands for monetary compensation or other relief, and correspondence and e-mails to the Owner or its representatives, which do not strictly comply with the requirements of this Section, are not claims under this Section. Failure to timely provide notice of intent to submit a claim shall preclude any relief to the Contractor, including but not limited to an extension of the Contract Completion Date or payment of additional compensation.
- b. Although the Contractor may be required to submit certain classes of claims prior to Final Payment, and the Contractor is not prevented from submitting claims during the pendency of the Work, the Owner shall not be obligated to render a final written decision on any claim until after Final Payment. No written decision denying a claim or addressing issues related to the claim shall be considered a denial pursuant to this Section unless the written decision makes express reference to this Section and is signed by the Agency head or his or her designee. The Contractor may not institute legal action prior to receipt of the Owner's final written decision on the claim unless the Owner fails to render such a decision within ninety (90) Days of submission of the claim or within ninety (90) Days of Final Payment, whichever is later.
- c. The decision of the Owner shall be final and conclusive unless the Contractor within six (6) months of the date of the final decision on a claim, initiates legal action as provided in *Code of Virginia* § 2.2-4364. Failure of the Owner to render a timely decision on a claim shall not result in the Contractor being awarded the relief claimed nor shall it result in any other relief or penalty. The sole result of the Owner's failure to render a timely decision shall be the Contractor's right to immediately institute legal action. No administrative appeals procedure pursuant to § 2.2-4365 of the *Code of Virginia* has been established for contractual claims under this Contract.
- d. Pursuant to *Code of Virginia*, § 2.2-4366, Alternative Dispute Resolution, the Owner may enter into an agreement with the Contractor to submit disputes arising from the performance of this Contract to arbitration and utilize mediation and other alternative dispute resolution procedures. However, such procedures entered into by the Owner, the Commonwealth, or any department, institution, division, commission, board or bureau thereof, shall be non-binding and subject to *Code of Virginia* § 2.2-514, as applicable. The details for the implementation of Alternative Dispute Resolution are provided in CPSM Section 3.2.7.
- e. In the event that a dispute, claim or controversy between the Owner and the Contractor arises regarding the requirements of the Contract, the performance of the Work, payment due the Contractor, the terms of any Change Order, or otherwise, the Contractor shall not stop, suspend or delay the Work or any part of the Work to be performed under the Contract, or under any Change Order, or as ordered by the Owner. The Contractor shall continue to diligently prosecute the Work to completion, including work required in any Change Order or as directed by the Owner.

- f. The Contractor shall submit a Contractor's Claim Certification (DGS-30-234) certifying that the claim is a true and accurate representation of the claim. Claims submitted without the Contractor's Claim Certification will be deemed incomplete and will not be considered.
- g. The compensation expressly provided for by this Contract shall be the Contractor's sole available compensation for the acts, omissions or breaches by the Owner. These remedies shall survive termination or breach of the Contract.

**48. ASBESTOS**

- a. This subsection applies to projects involving existing buildings where asbestos abatement is not a part of the Work, when the scope of the Project has been reviewed and a comprehensive survey conducted by an individual licensed by the Virginia Department of Professional and Occupational Regulation to conduct building inspections for asbestos-containing materials in buildings, and where the Owner has attempted to remove or encapsulate all asbestos-containing material that may become friable or damaged during this Project.

Prior to commencement of Work, the results of the comprehensive survey or any other asbestos survey shall be made available to the Contractor, who shall be responsible for performing his Work so as not to disturb any remaining asbestos, encapsulated or otherwise, identified in such survey or surveys.

If the Contractor discovers or inadvertently disturbs any material that he knows, should have known or has reason to believe, may contain asbestos that has not been previously identified, was overlooked during the removal, was deemed not to be friable or was encapsulated, the Contractor shall stop Work in the area containing or suspected to contain the asbestos, secure the area, and notify the Owner and the A/E immediately by telephone or in-person with written Notice as soon as possible. The Owner will have the suspect material sampled.

If the sample is positive and must be disturbed in the course of the Work, the Owner shall have the material repaired or removed and shall pay for the bulk sample analysis.

Except as provided in *Code of Virginia* § 11-4.1, if the material disturbed is not within the Contractor's authorized Work and/or Work area or under this Contract, the Contractor shall pay for all associated sampling and abatement costs.

- b. If asbestos abatement is included as a part of the Work, the Contractor shall assure that the asbestos abatement work is accomplished by those duly licensed as described in Section 3 of these General Conditions and in accordance with the specific requirements of the Contract and all applicable laws and regulations.
- c. If asbestos abatement is included as part of the Work, the licensed asbestos Subcontractor shall obtain the insurance required under Section 11(b)(4) of these General Conditions.

**49. TRAINING, OPERATION AND MAINTENANCE OF EQUIPMENT**

- a. As a part of the Work, the Contractor in conjunction with his Subcontractors and Suppliers shall provide the Owner's operations and maintenance personnel with adequate instruction and training in the proper operation and maintenance of any equipment, systems, and related controls provided or altered in the Work. The training requirements may be further defined in the Specifications.
- b. The Contractor shall provide the Owner with a minimum of two (2) copies of operating, maintenance and parts manuals for all equipment and systems provided in the Work. Further specific requirements may be indicated in the Specifications.

**50. PROJECT MEETINGS**

- a. The intention of this Section is that the Contractor, the Owner and the A/E have timely exchange of information and cooperate to accomplish the Work as required by the Contract Documents. The Contractor is responsible for managing the Work, obtaining approvals and requesting clarifications on a timely basis. The Owner and A/E are responsible for making a reasonable effort to provide timely responses to the Contractor.
- b. **Preconstruction Meeting:** Prior to the start of construction and no later than 15 Days after the Notice to Proceed, a “Preconstruction” meeting shall be held with attendees to include the Owner’s Project Manager and Project Inspector, the A/E’s project manager and representatives of each design discipline involved in the Project, the Regional Fire Marshal, the Contractor’s project manager and superintendent (and scheduler, if Contractor desires), and representatives of the Contractor’s major Subcontractors. The purpose of the meeting is to clarify and discuss the specifics related to, but not limited to, the following:
  1. Persons involved from each entity and their chain of authority including the names of persons authorized to sign Change Orders and any limits to their authority. Name of Contractor’s on-site certified Responsible Land Disturber.
  2. Names, addresses, email addresses, telephone numbers and FAX numbers to be used for Requests for Information (RFI), Requests for Clarification (RFC), Requests for Proposals (RFP), shop drawings, Submittals, and Notice.
  3. Contractor’s proposed construction schedule, the requirements for schedule updates and recovery schedules, assessment and management of risks to on-time and on-budget completion, and Owner’s sequencing requirements, if any.
  4. Schedule of Values and Certificate for Payment (CO-12) requirements and procedures.
  5. Procedures for shop drawings, product data and Submittals.
  6. Procedures for handling Field Orders and Change Order (CO-11).
  7. Procedures for Contractor’s request for time extension, if any.
  8. Construction Site requirements, procedures and clarifications to include:
    - Manner of conducting the Work
    - Site specialties such as dust and erosion control, stormwater management, project signs, clean up and housekeeping, temporary facilities, utilities, security, and traffic
    - Safety
    - Layout of the Work
    - Quality control, testing, inspections, and notices required
    - Site visits by the A/E and others
    - Owner’s Project Inspector duties
    - Running Punch List
    - As-Built Drawings
  9. Procedures and documentation of differing or unforeseen Site conditions.
  10. Monthly Pay Meeting.
  11. Assignment of responsibility for generation of meeting minutes of all project meetings.
  12. Project Close-Out requirements and procedures.

13. Project records.
  14. Requirements for the Contractor to furnish the Owner a list of hazardous materials that may be brought onto the job site, and 48- hour notification requirement.
- c. **Monthly Pay Meeting:** Section 36 establishes the requirement for a monthly pay meeting which will usually be held at or near the Site. In addition to Owner, A/E and Contractor representatives, the following representatives, at a minimum, should be available to attend portions of the meeting, as applicable or necessary:
- Owner's Project Inspector
  - Contractor's project superintendent
  - A/E representative of each discipline where Work was performed for the current pay request or where Work is projected to be performed in the coming month.
  - A representative of each subcontractor who performed work included in the current pay request.
  - A representative of each subcontractor who is projected to perform work in the coming month.

The following topics should be included, as a minimum, in the monthly pay meeting:

1. Observations of status, quality and workmanship of Work in progress
  2. Validation of the Schedule of Values and Certificate for payment
  3. Status of progress of the Work and conformance with proposed construction schedule and recovery schedule, if any
  4. Outstanding Requests for Information, Requests for Clarification and Requests for Proposal
  5. Submittals with action pending
  6. Status of pending Change Orders
  7. Status of Running Punch List items
  8. Work proposed for coming pay period
  9. Discussions of any problems or potential problems which need attention
- d. **Other Meetings:** Requirements for other meetings, such as progress meetings, coordination meetings, pre-installation meetings and/or partnering meetings, may be included in the Contract Documents.

## 51. SMALL BUSINESS PROCUREMENT PLAN

If the Total Contract Amount of the Contract is greater than \$10,000 and the Contractor is a SWaM/SDV Business; then the Contractor shall include a Small Business Procurement Plan in its Bid (if subcontracting work is intended by the Contract as part of its performance of the Work).

If the Total Contract Amount of the Contract is greater than \$100,000, then the Contractor shall include in its Bid a Small Business Procurement Plan and report on the involvement of SWaM/SDV Businesses in the Contractor's performance of the Contract as follows:

1. **Periodic Progress Reports:** The Contractor shall report on involvement of SWaM/SDV Business with each periodic invoice submitted by the Contractor. The report shall identify each subcontract or agreement with a SWaM/SDV Business, including the total contract value, and state the total amounts paid to each SWaM/SDV Business in connection with the Contract as of the report date. The report shall provide this information separately for each type of SWaM/SDV Business and shall clearly indicate those SWaM/SDV Businesses which were identified in the Contractor's Small Business Procurement Plan submitted by the Contractor in the procurement phase for the Contract. The Contractor shall provide two (2) copies of each periodic report to the Owner. Failure to submit the report with each invoice will result in the invoice being rejected by the Owner without payment.
2. **Final Compliance Report:** Prior to or with its final invoice for payment, the Contractor shall certify and report on its compliance with the Small Business Procurement Plan, submitted by the Contractor in its Bid for the Contract, to the Owner through DGS' eVA system. In the Final Compliance Report, the Contractor shall:
  - Provide a written explanation to the Owner of any variances between the Contractor's Small Business Procurement Plan and the actual participation of SWaM/SDV Businesses in the Contractor's performance of the Contract; and
  - Report on the involvement of other SWaM/SDV Businesses in the Contractor's performance of the Contract, including the contract value, the type of SWaM/SDV Business, a comparison of the actual amount paid with the planned amounts, the total amount paid to each type of SWaM/SDV Business, and a calculation of the percentage of the Total Contract Amount paid to SWaM/SDV Business.

A format for the Final Compliance Report will be provided by the Owner.

The Owner may withhold final payment to the Contractor until the Contractor has complied with the requirements of its Small Business Procurement Plan submitted by the Contractor in the procurement phase for the Contract.

\* \* \* E N D O F G E N E R A L C O N D I T I O N S \* \* \*

SECTION 005020  
LIST OF DRAWINGS

01 - SPECIFICATIONS

- A. Index to Specifications is found in front of this Project Manual on sheets titled "Table of Contents".

02 – DRAWINGS

GENERAL

T001 COVER SHEET

LIFE SAFETY

A001 CODE SUMMARY, FIXTURE SCHEDULE & LIFE SAFETY PLAN

ARCHITECTURAL

A002 PARTITION TYPES, DOOR SCHEDULE & ELEVATIONS & SIGNAGE  
A003 UL ASSEMBLIES & JOINT / PENETRATION DETAILS  
A041 DEMOLITION PLAN  
A101 FLOOR PLAN  
A111 INTERIOR DETAILS & ELEVATIONS  
A121 REFLECTED CEILING PLAN  
A151 ROOF PLAN  
A301 BUILDING SECTIONS & REFLECTED CEILING PLAN DETAILS  
A501 ENLARGED TOILET PLAN & DETAILS  
A721 CASEWORK  
A722 CASEWORK & FINISH SCHEDULE  
A800 FURNITURE PLANS – FOR REFERENCE ONLY

PLUMBING

P001 PLUMBING LEGEND AND SCHEDULES  
P201 PLUMBING OVERALL PLAN  
P301 PLUMBING ENLARGED PLANS

MECHANICAL

M001 MECHANICAL LEGEND AND SCHEDULES  
M002 MECHANICAL DETAILS  
M003 MECHANICAL DETAILS  
M201 MECHANICAL DEMOLITION PLAN  
M202 MECHANICAL DEMOLITION PLAN PIPING  
M301 MECHANICAL NEW WORK PLAN  
M302 MECHANICAL NEW WORK ROOF PLAN  
M401 MECHANICAL NEW WORK PLAN PIPING  
M501 MECHANICAL CONTROLS

ELECTRICAL

E001	ELECTRICAL LEGEND AND ABBREVIATIONS
E002	ELECTRICAL DEMOLITION PLAN AND GENERAL NOTES
E101	ELECTRICAL POWER PLAN
E102	ELECTRICAL LIGHTING PLANS
E103	ELECTRICAL LIGHTING CALCULATIONS
E501	ELECTRICAL DETAILS
E601	ELECTRICAL PANEL SCHEDULES
E602	ELECTRICAL PANEL SCHEDULES
E650	ELECTRICAL RISER DIAGRAMS
E651	ELECTRICAL DIAGRAMS

END OF SECTION

**PARTICIPATION IN STATE PROCUREMENT TRANSACTIONS  
BY  
MICRO BUSINESSES, SMALL BUSINESSES,  
AND  
BUSINESSES OWNED BY WOMEN, MINORITIES AND SERVICE-DISABLED VETERANS**

The Proposer is required to provide information concerning utilization of micro businesses, small businesses, women-owned businesses, minority-owned businesses and service-disabled veteran-owned businesses proposed for this project as well as on past projects. Failure to complete and return this form with the response to the RFP will result in the proposing firm being considered “non-responsive”.

**PART I – DEFINITIONS**

The definitions below are applicable to vendors doing business with the Commonwealth of Virginia. Federal definitions shall govern with respect to meeting federally funded highway construction and other federally financed programs.

**DSBSD:** Virginia Department of Small Business and Supplier Diversity

**Historically Black Colleges and Universities:** Any college or university that was established prior to 1964; whose principal mission was, and is, the education of black Americans; and that is accredited by a nationally recognized accrediting agency or association determined by the Secretary of Education.

**Micro Business:** A small business certified as such by the Virginia Department of Small Business and Supplier Diversity (DSBSD). For purposes of DSBSD micro certification, the business must have no more than 25 employees and has no more than \$3 million in average annual revenue over the three-year period prior to certification.

**Minority Individual:** An individual who is a citizen of the United States or a legal resident alien and who satisfies one or more of the following definitions:

- 1. African American:** A person having origins in any of the original peoples of Africa and who is regarded as such by the community of which this person claims to be a part.
- 2. Asian American:** A person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands, including but not limited to Japan, China, Vietnam, Samoa, Laos, Cambodia, Taiwan, Northern Mariana Islands, the Philippines, a U.S. territory of the Pacific, India, Pakistan, Bangladesh, or Sri Lanka, and who is regarded as such by the community of which this person claims to be a part.
- 3. Hispanic American:** A person having origins in any of the Spanish-speaking peoples of Mexico, South or Central America, or the Caribbean Islands or other Spanish or Portuguese cultures and who is regarded as such by the community of which this person claims to be a part.
- 4. Native American:** A person having origins in any of the original peoples of North America and who is regarded as such by the community of which this person claims to be a part or who is recognized by a tribal organization.

**Minority-Owned Business:** A business certified as such by the Virginia Department of Small Business and Supplier Diversity (DSBSD). The *Code of Virginia* defines this to include businesses that are at least 51 percent owned by one or more minority individuals who are U.S. citizens or legal resident aliens, or in the case of a corporation, partnership, or limited liability company or other entity, at least 51 percent of the equity ownership interest in the corporation, partnership, or limited liability company or other entity is owned by one or more minority individuals who are U.S. citizens or legal resident aliens, and both the management and daily business operations are controlled by one or more minority individuals, or any historically black college or university, regardless of the percentage ownership by minority individuals or, in the case of a corporation, partnership, or limited liability company or other entity, the equity ownership interest in the corporation, partnership, or limited

**Service Disabled Veteran:** A veteran who (i) served on active duty in the United States military ground, naval, or air service, (ii) was discharged or released under conditions other than dishonorable, and (iii) has a service-connected disability rating fixed by the United States Department of Veterans Affairs.

**Service Disabled Veteran-Owned Business:** A business certified as such by the Virginia Department of Small Business and Supplier Diversity (DSBSD). The *Code of Virginia* defines this to include businesses that are at least 51 percent owned by one or more service disabled veterans or, in the case of a corporation, partnership, or limited liability company or other entity, at least 51 percent of the equity ownership interest in the corporation, partnership, or limited liability company or other entity is owned by one or more individuals who are service disabled veterans and both the management and daily business operations are controlled by one or more individuals who are service disabled veterans.

**Small Business:** A business certified by the Virginia Department of Small Business and Supplier Diversity (DSBSD) as compliant with *Code of Virginia*, §§ 2.2-1604 and 2.2-4310. The *Code of Virginia* defines a “small business” as one that is at least 51% independently owned and controlled by one or more individuals, or in the case of a cooperative association organized pursuant to Chapter 3 (§ 13.1-301 et seq.) of Title 13.1 as a nonstock corporation, controlled by one or more members, who are U.S. citizens or legal resident aliens, and together with affiliates, has 250 or fewer employees or average gross receipts of \$10 million or less averaged over the previous three years. One or more of the individual owners or members shall control both the management and daily business operations of

**Women-Owned Business:** A business certified as such by the Virginia Department of Small Business and Supplier Diversity (DSBSD). The *Code of Virginia* defines this to include businesses which are at least 51 percent owned by one or more women who are U.S. citizens or legal resident aliens, or in the case of a corporation, partnership, or limited liability company or other entity, at least 51 percent of the equity ownership interest is owned by one or more women who are U.S. citizens or legal resident aliens, and both the management and daily business operations are controlled by one or more women.

**DGS-30-360**

(Rev. 07/22)

**PART II**  
**DATA ON FIRM SUBMITTING PROPOSAL**

**OFFEROR / PROPOSER:**

Firm Name:

Contact Person:

Phone Number:

DPOR Registration # :

**PROPOSAL FOR:**

Agency:

Project Title:

Project Code No.:

**PARTICIPATION STATUS:**

As defined by Part I:

VA Department of  
Small Business and  
Supplier Diversity  
**(DSBSD) Certificate #**

Is the Proposer a Micro Business?

☐

Is the Proposer a Small Business?

☐

Is the Proposer a Woman-Owned Business?

☐

Is the Proposer a Minority-Owned Business?

☐

Is the Proposer a Service-Disabled Veteran-Owned Small Business?

☐

**REMARKS / COMMENTS:**

## PART III

Firm Name:

**Phone Number:****Phone Number:**

1: \_\_\_\_\_

**Agency:**

**Code No.:**

Project Code No.:

List Offeror's plans to involve micro businesses, small businesses, businesses owned by women, businesses owned by minorities, and businesses owned by service-disabled veterans in the performance of this contract either as part of a joint venture, as a partnership, as subcontractors, as consultants, or as suppliers. Offerors are encouraged to provide additional information and expand upon the following format.

[illegible]

**LISTING OF PAST UTILIZATION OF SMALL/DIVERSE BUSINESSES BY PROPOSER**  
**(Complete additional pages if needed)**

**OFFEROR / PROPOSER:**

<b>Firm Name:</b>	
<b>Contact Person:</b>	
<b>Phone Number:</b>	

Date Form Completed: \_\_\_\_\_  
Is this the final report? \_\_\_\_\_

**SMALL BUSINESS UTILIZATION REPORT FOR PAST PROJECT:**

<b>Agency:</b>		<b>Proposed small business participation:</b>	%
<b>Project:</b>		<b>Actual small business participation:</b>	%
<b>Project Code No.:</b>	<i>(Include ONLY small and micro business participation)</i>		

List micro businesses, small businesses, businesses owned by women, businesses owned by minorities, and businesses owned by service-disabled veterans with which the offeror has contracted or done business with on the project noted above. Also list the dollar amount spent with each of these businesses. Offerors are encouraged to provide additional information and expand upon the following format.

[illegible]

DOCUMENT 010010  
VIRGINIA WESTERN COMMUNITY COLLEGE  
GENERAL CONTRACT REQUIREMENTS

1.1 SUMMARY

- A. Document Includes:
  - 1. Virginia Western Community College – General Contract Requirements.
- B. Related Documents:
  - 1. Instructions to Bidders DGS-30-055 (CO-7A)
  - 2. General Conditions of the Construction Contract DGS-30-054 (CO-7)
  - 3. Supplemental General Conditions DGS-30-376 (CO-7)

1.2 CONTRACT REQUIREMENTS

- A. The terms used in these requirements which are defined in the General Conditions of the Construction Contract DGS-30-054, have the meanings assigned to them in the General Conditions.

END OF DOCUMENT

VIRGINIA WESTERN COMMUNITY COLLEGE  
GENERAL CONTRACT REQUIREMENTS

1. At the Owner's option, the Owner will furnish water and electricity for construction purposes. However, the Contractor will be responsible for making connections to Owner's utilities and extending to the construction site. Where the Contractor deems that the Owner's utilities are an unreasonable distance from the construction site, the Contractor shall then be responsible for providing water and electricity for construction. Any service altered for use by the Contractor shall be restored back to original before construction is complete.
2. The Owner will pay for all permanent utility connection fees and the use of utilities to serve the new facility through the contract construction period. The Contractor shall be responsible for requesting and coordinating such connections and shall take reasonable precautions to avoid wasteful use of water, electricity and natural gas. The Contractor shall reimburse the Owner for utility costs incurred as a result of delays in construction, from the time of contract completion until occupancy.
3. The Contractor shall provide temporary fencing, barricades and other barriers as needed to protect the public from the construction operations. During renovations in occupied buildings, all means necessary shall be taken by the Contractor to ensure safety and protect the public from the construction operations.
4. The Contractor shall maintain existing utility systems to adjacent buildings in full operation during construction. These shall include but not be limited to water, sanitary sewer, natural gas, electrical, telephone, data and storm sewers. In instances when temporary disruptions are required to make connections, the Contractor shall schedule such work to be done during a time that facilities served by the utility are unoccupied, as approved by the Owner. A minimum notice of 5 days shall be given to the Owner prior to shutdown. The same consideration shall be provided with regard to the operation of electrical, mechanical and other building systems in adjacent buildings.
5. The Contractor shall provide the Owner with two sets of shop drawings in addition to those required for use by the Architect and Engineer. The Owner will simultaneously review all products and systems that impact the aesthetics of the design.
6. The Pre-Bid Conference shall be non-mandatory.
7. The following items are critical when working next to active classrooms and administration areas. Coordinate the following with the Owner to his satisfaction, providing not less than 48 hours notice of operations that may affect continued occupancy of the space or adjacent spaces:
  - a. Emergency exits adjacent to construction shall be kept open and safe. Construction of temporary barriers by Contractor will be required when work is affecting emergency exits.
  - b. Noise reduction during hours of operation.
  - c. Dust reduction unless sufficient barriers are installed to prevent dust migration.
  - d. Scheduling of building and utility shutdowns.
8. General Warranty: A general building warranty is outlined in CO-7, paragraphs 30 and 45. In addition to those requirements stated in CO-7, immediate response call-backs to address certain important warranty issues shall be covered regardless of the time of repair work required or completed. Immediate response call-back items

VIRGINIA WESTERN COMMUNITY COLLEGE  
GENERAL CONTRACT REQUIREMENTS

include: Fire alarm system, emergency generators (including transfer switching), elevator, HVAC system (including all associated controls), plumbing, electrical system and building security (including door hardware and locks). The Contractor shall have all necessary components repaired immediately with no surcharge (i.e. overtime or premium rates) charged to the Owner for the duration of the one year general building warranty.

9. Indoor Air Quality: Maintain acceptable indoor air quality throughout construction period, in accordance with established laws and guidelines:
  - a. Eliminate entry of water into the building construction.
  - b. Maintain the interior of all air handling equipment and components clean and dry.
  - c. Replace filters as many times as necessary throughout construction when the filters become clogged with construction dust.
  - d. Inspect construction site daily for plumbing leaks, water leaks and other water damage to building materials. Remove standing water immediately. Replace building materials damaged by water or biological growth.
  - e. Store non-weatherized air handling equipment and components in a protected area to prevent exposure to water and construction dust.
  - f. Cover open ends of ductwork immediately after installation with polyethylene sheets, sealed completely until all ductwork and components are in place and operational.
  - g. Prior to substantial completion:
    - i. Thoroughly clean the interior of all air handling equipment and components.
    - ii. Remove temporary filters and install new filters in all mechanical equipment.
    - iii. Replace all construction material that has been damaged by water and biological growth.
10. Provide to the Owner a written plan suitable to address the following:
  - a. Construction activity noise control.
  - b. Construction activity odor and airborne pollutant control.
  - c. Plan for utility shutdowns.
  - d. Proposed areas for construction access.
11. All existing curbs, walks, paths and pavement damaged by the construction shall be removed back to the nearest control or expansion joint, curb, or slab edge and be replaced in-kind. Color, finish, tooling and patterns shall match the existing surface and material and be approved by the Owner.
12. The Contractor shall provide temporary sanitary facilities for all construction workers, including sub-contractors, suppliers and workers under control of the Contractor. Campus bathrooms are not to be used at any time during the construction period by the Contractor.
13. The Contractor shall be responsible for the conduct, language and behavior of all workers while on site to maintain a safe and harassment-free campus. The Owner retains the right to have workers under control of the Contractor removed from site if

VIRGINIA WESTERN COMMUNITY COLLEGE  
GENERAL CONTRACT REQUIREMENTS

workers are found to be using inappropriate language or harassing students, faculty or staff.

14. Photo identification will be required for all of the construction workers employed under this contract. The identification shall be worn at all times and presented to College personnel when requested. Failure to display the photo identification by any construction personnel can result in removal of that individual from the campus property, and this removal will not affect the completion date of the project.

15. Submittals for Review:

- a. All submittals must be thoroughly reviewed and stamped by the Contractor prior to release to the A/E and Owner. Failure of the Contractor to perform this initial review will result in return of the submittal without review by the A/E.
- b. Contractor is responsible for any delay caused by failure to provide this initial review.
- c. Contractor shall provide ample time in the schedule for the allowable A/E review period, procurement, fabrication, delivery and installation of each product. Requests by the Contractor to have the A/E expedite submittal reviews shall be agreed upon in advance by all parties.
- d. Refer to the Contract Documents for the allowable review period.
- e. Owner will review all items that affect the aesthetics of the finished construction prior to final release of the shop drawings to the Contractor. Included: colors, finishes, textures, manufacturers of flooring, walls and ceilings; door hardware; door colors and materials; light fixtures; plumbing fixtures; furnishings (when applicable); landscaping; exterior concrete.

16. Substitutions:

- a. All substitutions proposed by the Contractor shall include complete data and information which substantiate the compliance of the proposed substitution with the requirements of the Contract Documents. Included in the information shall be certified tests which prove the proposed substitution's equivalence to the specified item. The burden of proving equivalence is solely on the Contractor.
- b. Proposed substitutions will not be considered when the Contractor requests informally through a shop drawing submittal.
- c. Allow a minimum 21 calendar days for review of the substitution by the A/E and the Owner. Extensions of the construction schedule due to additional review time will not be allowed.
- d. When a substitution is requested by the Contractor, it must meet the following conditions:
  - i. It meets or exceeds the quality level of the specified product or system.
  - ii. It meets or exceeds the warranty/guarantee period of the specified product or system.
  - iii. The proposed substitution can be accommodated in the construction without modification or redesign to other systems. Should redesign be required, it is the sole responsibility of the Contractor to arrange and pay for these services.

VIRGINIA WESTERN COMMUNITY COLLEGE  
GENERAL CONTRACT REQUIREMENTS

All efforts to accommodate the proposed substitution including design services will be at no cost to the Owner or A/E.

- iv. The proposed substitution and any modifications will not increase the costs of construction.
- v. The proposed substitution and any modifications will not increase the time of construction.
- vi. The proposed substitution and any modifications will not change the aesthetics of the finished construction, when applicable.
- e. Substitutions will be considered when the specified product or system becomes unavailable through no fault of the Contractor.

17. Construction Schedules:

- a. Contractor to submit preliminary construction schedule 2 weeks after signing of contract. A/E and Owner will review and comment.
- b. Contractor to submit detailed construction schedule 45 days after signing of contract.
- c. Construction schedule shall be updated every four weeks and be included as part of each monthly construction meeting. When a revision to the construction schedule affects the overall construction schedule, a description of the problem area(s) along with solutions to bring the project back in line with the original schedule will be required.

18. Quality:

- a. Contractor is responsible to coordinate all testing and inspection services throughout the construction period.
- b. Testing and Inspection agency shall notify the A/E and Owner immediately of any non-conformance with the Project Documents. The testing and inspection agency does not have the authority to stop the work.
- c. Should a non-conformance be found during the course of construction, the Contractor may proceed at their own risk. When the Contractor takes this responsibility, all costs associated with correction, redesign and retesting of subject building components which do not meet Contract Specifications shall be paid by the Contractor.
- d. All test and inspection reports shall be submitted within 24 hours to the A/E and Owner.

19. Temporary Facilities and Controls: Contractor shall provide and maintain all temporary facilities for the duration of the project. Temporary facilities shall include:

- a. The designated construction area shall be fully enclosed and secure from pedestrians. The construction trailer, staging, storage and all other Contractor support services shall be located within the designated area.
- b. Sanitary facilities for use by all construction workers. Sanitary facilities shall be emptied and maintained on a regular basis.

VIRGINIA WESTERN COMMUNITY COLLEGE  
GENERAL CONTRACT REQUIREMENTS

- c. Interior enclosures required for work existing occupied spaces shall be maintained constantly to prevent construction debris and pedestrians from entering the construction area.
  - d. Contractor shall provide waste removal services as required to maintain the site in a clean and orderly condition. Remove trash from site daily. All noxious and odorous products shall be securely contained and stored away from occupied buildings.
  - e. Provide protection of all existing and new work. Refer to individual specifications for additional information.
  - f. Contractor is responsible to remove all temporary facilities and controls, including temporary utilities. Clean site thoroughly, and restore all damaged pavement, curbing, landscaping, and sod as noted in other specification sections.
20. Vehicular Access and Parking: Contractor to coordinate with Owner allowable areas of access, parking and driveways. Contractor shall not park in areas not designated for construction vehicles.
21. Security: The Contractor is responsible for securing the construction site.
- a. Restrict entrance of persons and vehicles into the project site.
  - b. Allow entrance only to authorized persons with identification.
  - c. Maintain log of workers and visitors, and provide to Owner updates to log at each progress meeting.
  - d. Contractor shall coordinate all security measures and issues with Campus Police.
  - e. All workers including subcontractors shall prominently wear photo-identification badges while working on all Campus construction projects. The badge shall have a minimum size of 2" x 3-1/2", made of durable plastic and have the name of the person and company.
  - f. Failure to wear photo-identification could result in removal from campus property. If individuals are removed from campus property for failure to wear photo-identification, the Contractor will not have a right to submit a delay claim as a result of these actions.
  - g. Employees of the General Contractor and all Sub-Contractors who will be performing work on the campus are to be checked by the General Contractor for inclusion in Virginia's Sex Offender Registry (<http://sex-offender.vsp.virginia.gov/sor>). This information needs to be complete, accurate and be available for review by the College at any moment. Should an individual be included in this database, that individual will not be allowed to work on campus and must be removed from the project immediately.
22. Project Signs: Project identification signage is not required by the Owner. Should the Contractor choose to place a project sign on the Campus, it is the Contractors' responsibility to design the sign to meet Building Code requirements and to maintain the condition of the sign for the duration of construction. Location of sign will be coordinated with the Owner. Removal of the sign shall occur prior to the end of construction, and the Contractor is responsible to restore the area where the sign was located.

VIRGINIA WESTERN COMMUNITY COLLEGE  
GENERAL CONTRACT REQUIREMENTS

23. Product Requirements:

- a. All shop drawings and product submittals of components that are architectural and aesthetic in nature must be reviewed by the Owner prior to release to the Contractor. These include the following:
  - i. Visual site components, colors and textures
  - ii. Exposed concrete including texture
  - iii. Painting of exposed structure
  - iv. Interior painted finishes, including walls, soffits, bulkheads and doorframes
  - v. Floor finishes, including VCT, sheet linoleum, carpeting and rolled base
  - vi. Ceiling types, textures, finishes and colors
- b. Owner Supplied Items: When the Owner supplies equipment or items for installation by the Contractor, the Contractor shall take into account all associated costs for installation such as additional electrical, mechanical, plumbing, etc. Contractor shall also coordinate Owner-supplied equipment with Contractor-supplied equipment as necessary.

END OF SECTION

SECTION 010150  
CONTRACTOR'S USE OF THE PREMISES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General Conditions, Special Conditions and Division 1 - Specifications Sections, apply to work of this section.

1.02 DESCRIPTION:

A. Work Included:

1. This section applies to situations in which the Contractor or his representatives including, but not necessarily limited to, suppliers, sub-contractors, employees, and field engineers, enter upon the Owner's property.
2. Include coordination for the following items that are critical when working next to adjacent buildings with active classrooms and administration areas:
  - a. Emergency exits adjacent to construction shall be kept open and safe. Construction of temporary barriers by Contractor will be required when work affects emergency exits.
  - b. Noise reduction during hours of operation (such as saw cutting materials).
  - c. Dust reduction unless sufficient barriers are installed to prevent dust migration (such as saw cutting materials).
  - d. Scheduling of building and utility shutdowns.
2. Provide to the Owner a written plan suitable to address the following:
  - (1) Construction activity noise control.
  - (2) Construction activity odor and airborne pollutant control.
  - (3) Plan for utility shutdowns.
  - (4) Proposed areas for construction access.

- B. The Contractor shall be responsible for the conduct, language and behavior of all workers while on site to maintain a safe and harassment-free campus. The Owner retains the right to have workers under control of the Contractor removed from site if workers are found to be inappropriate language or harassing students, faculty or staff.

Contractor employee identification will be required for all of the construction workers employed under this contract. The identification shall be worn at all times and presented to College personnel when requested. Failure to display the identification by any construction personnel can result in removal of that individual from the campus property, and this removal will not affect the completion date of the project.

- C. Security: The Contractor is responsible for securing the construction site.
1. Restrict entrance of persons and vehicles into the project site.
  2. Allow entrance only to authorized persons with identification.
  3. Maintain log of workers and visitors, and provide to Owner updates to log at each progress meeting.
  4. Contractor shall coordinate all security measures and issues with Campus Police.
  5. All workers including subcontractors shall prominently wear photo-identification badges while working on all Campus construction projects. The badge shall have a minimum size of 2" x 3-1/2", made of durable plastic and have the name of the person and company. A company shirt with logo may be used in lieu of photo identification.
  6. Failure to wear approved identification could result in removal from campus property. If individuals are removed from campus property for failure to wear identification, the Contractor will not have a right to submit a delay claim as a result of these actions.
  7. Employees of the General Contractor and all Sub-Contractors who will be performing work on the campus are to be checked by the General Contractor for inclusion in Virginia's Sex Offender Registry (<http://sex-offender.vsp.virginia.gov/sor>). This information needs to be complete, accurate and be available for review by the College at any moment. Should an individual be included in this database, that individual will not be allowed to work on campus and must be removed from the project immediately.
- D. Required that all shut downs not only be coordinated with VWCC but that they occur nights or weekends on our approved/agreed upon schedule.
- E. Quality:
1. Testing and inspection services are outlined in the Construction Documents and will be hired by the Owner.
  2. Contractor is responsible to coordinate all testing and inspection services throughout the construction period.

3. Testing and Inspection agency shall notify the A/E and Owner immediately of any non-conformance with the Project Documents. The testing and inspection agency does not have the authority to stop the work.
  4. Should a non-conformance be found during the course of construction, the Contractor may proceed at their own risk. When the Contractor takes this responsibility, all costs associated with correction, redesign and retesting of subject building components which do not meet Contract Specifications shall be paid by the Contractor.
  5. All test and inspection reports shall be submitted within 24 hours to the A/E and Owner.
- F. Project Signs: Project identification signage is not required by the Owner. Should the Contractor choose to place a project sign on the Campus, it is the Contractors' responsibility to design the sign to meet Building Code requirements and to maintain the condition of the sign for the duration of construction. Location of sign will be coordinated with the Owner. Removal of the sign shall occur prior to the end of construction, and the Contractor is responsible to restore the area where the sign was located.

#### 1.02 QUALITY ASSURANCE:

- A. Promptly upon award of the Contract, notify all pertinent personnel regarding requirements of this section.
- B. Require that all personnel who will enter upon the Owner's property certify their awareness of and familiarity with requirements of this section.

#### 1.03 SUBMITTALS:

Submit to the Owner a record of names and identification of all persons who will be entering upon the Owner's property in connection with the work of this Contract. All persons on the job site is required to have identification (company shirt, badge, etc.) visible at all times.

#### 1.04 CONTRACTOR'S VEHICLES:

Parking for Contractor's vehicles and vehicles belonging to employees of the Contractor, and all other vehicles entering upon the Owner's property in performance of the work of the Contract shall only use the parking and access route as authorized by the Owner. Parking is limited on site. There will be a necessity for some off-site parking.

1.05 SECURITY:

Restrict the access of all persons entering upon the Owner's property in connection with the work to the access route and to the actual site of the work. Refer to Section 34 of the "General Conditions."

1.06 CONTRACTOR'S USE OF EXISTING BUILDINGS:

- A. Use of existing buildings will not be permitted, except in the actual area of the work. The Contractor shall not allow the use of the Owner's toilet facilities by the Contractor's personnel, sub-Contractor personnel, or other persons upon entering the Owner's buildings in connection with the work. Refer to Section 31 of the "General Conditions."
- B. The Contractor shall keep public areas free from accumulation of waste materials, rubbish, trash, and all forms of construction debris. The Contractor is required to remove all accumulation of waste materials, rubbish, trash, and all forms of construction debris daily.
- C. Contractor shall restore to original condition any plantings, grassed areas, utilities, roads, structures and other damages as a result of his operations, at no additional cost to the Owner.
- D. The Owner will pay for all permanent utility connection fees and the use of utilities to serve the new facility through the contract construction period. The Contractor shall be responsible for requesting and coordinating such connections and shall take reasonable precautions to avoid wasteful use of water, electricity and natural gas. The Contractor shall reimburse the Owner for utility costs incurred as a result of delays in construction, from the time of contract completion until occupancy.

1.07 TIME OF WORK and OWNER OCCUPANCY:

- A. Unless otherwise permitted, no construction work shall be done between the hours of 9:00 P.M. and 6:00 A.M. Eastern Standard Time, nor on Sunday, or holidays, except as necessary for the protection of the public and the proper care of work already performed.
- B. Should it become imperative to perform work beyond the time limits stipulated above, the Contractor is to coordinate with the Owner for approval of variance of time schedule. The Contractor shall obey all local ordinances and shall obtain any waivers necessary for working beyond the time limits specified.
- C. Contractor may be provided a schedule of events by the Owner for the building for which construction activities is intended to occur. The owner may notify the contractor if his construction activity would interfere with any events. Owner shall notify the Contractor and the A/E if work needs to be terminated due to any event. If so, at the Contractor's request, additional time for project completion equal to time lost for the event may be awarded.

- D. The Owner will occupy the site and all facilities located at the site during the period of construction. Fishburn Hall (the building) will be completely unoccupied for a period of 5 weeks at the beginning of construction. Subsequently, entire single floors can be completely unoccupied. The Contractor shall cooperate fully with the Owner and any of his representatives during construction operations to minimize conflicts and to facilitate the Owner's usage, class schedule, and other facility operations.
- E. The Contractor shall not interfere with the operation of equipment and services in those areas of the facility where work is not scheduled and where the Owner, students, employees, and others occupy the facility, facilities, and/or site.
- F. Construction shall be performed by the Contractor such that all spaces within the building be fully accessible and safely usable at all times.
- G. Contractor shall coordinate his intended work schedule with the Owner at the Pre-Construction Conference.
- H. Contractor shall not allow fumes associated with vehicles, equipment or materials and processes of the construction to enter buildings. This includes building where work is occurring and adjacent buildings. Contractor shall coordinate with Owner efforts to filter or temporarily block air intakes. No fresh air intakes shall be blocked without consent of Owner, and coordination with Owner.
- I. Noise shall also be abated as much as practical by use of properly muffled equipment. Cursing, swearing and misconduct of construction workers is prohibited on site. Contractor's workers reported to be participating in these behaviors shall be removed and replace.
- J. Construction Schedules:
  - 1. Contractor to submit preliminary construction schedule 2 weeks after signing of contract. A/E and Owner will review and comment.
  - 2. Contractor to submit detailed construction schedule 45 days after signing of contract.
  - 3. Construction schedule shall be updated every four weeks and be included as part of each monthly construction meeting. When a revision to the construction schedule affects the overall construction schedule, a description of the problem area(s) along with solutions to bring the project back in line with the original schedule will be required.

END OF SECTION

## SECTION 011000 SUMMARY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Work covered by the Contract Documents.
  - 2. Use of premises.
  - 3. Pre-Construction Meeting
  - 4. Occupancy – Owner will not occupy the building during construction.
  - 5. Work restrictions.

#### 1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: As described in the Invitation For Bids.

#### 1.4 USE OF PREMISES

- A. General: Contractor shall have full use of premises for construction operations.
- B. Maintain means of egress and required accessible means of egress throughout entire duration of the project per Virginia Construction code (VCC)2021 section 3310.2, per Virginia Statewide Fire Prevention Code (VSFPC)2021 section 3312.2, and per Virginia Existing Building Code (VEBC)2021 section 1205.2.
- C. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
  - 1. Limits: Confine constructions operations to areas within defined active phase of work only.
  - 2. Owner Occupancy: The single story building shall not be occupied by the Owner or accessible to the public during construction.
  - 3. Schedule of Work: Contractor must coordinate schedule or work with the Owner and give notice of any change to the schedule to the Owner in advance.
  - 4. Driveways and Entrances: Keep driveways, loading areas, parking areas and driveway entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances.

- b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- D. Use of Existing Buildings: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building during construction period.
- E. The Contractor shall provide temporary fencing, barricades and other barriers as needed to protect the public from the construction operations. Provide and install pedestrian traffic flow signage. Owner approval of all pedestrian routing shall be obtained prior to installation. Refer to Section 031000 SITE PREPARATION, Paragraph 3.2 for additional information. The building shall not be occupied during construction.
- F. Photo identification will be required for all of the construction workers employed under this contract. The identification shall be worn at all times and presented to College personnel when requested. Failure to display the photo identification by any construction personnel can result in removal of that individual from the campus property, and this removal will not affect the completion date of the project.
- G. Employees of the General Contractor and all Sub-Contractors who will be performing work on the campus are to be checked by the General Contractor for inclusion in Virginia's Sex Offender Registry (<http://sex-offender.vsp.virginia.gov/sor>). This information needs to be complete, accurate and be available for review by the College at any moment. Should an individual be included in this database, that individual will not be allowed to work on campus and must be removed from the project immediately.

## 1.5 PRE-CONSTRUCTION MEETING

- A. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
  - 1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Critical work sequencing and long-lead items.
    - c. Designation of key personnel and their duties.
    - d. Procedures for processing field decisions and Change Orders.
    - e. Procedures for RFIs.
    - f. Procedures for processing Applications for Payment.
    - g. Submittal procedures.
    - h. Use of the premises and existing building.
    - i. Work restrictions.
    - j. Responsibility for temporary facilities and controls.

- k. Construction waste management and recycling.
  - l. Parking availability.
  - m. Office, work, and storage areas.
  - n. Equipment deliveries and priorities.
  - o. First aid.
  - p. Security.
  - q. Progress cleaning.
  - r. Working hours.
3. Minutes: Record and distribute meeting minutes.

#### 1.6 OCCUPANCY – BUILDING TO BE VACATED

- A. Owner will not occupy the building during entire construction period. Perform the Work so as not to interfere with Owner's day-to-day operations adjacent to the building. Maintain existing exits per Paragraph 1.4.B above.
- 1. Maintain access to existing sidewalks and other adjacent occupied or used facilities. Do not close or obstruct sidewalks or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
  - 2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building after Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
- 1. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
  - 2. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

#### 1.7 WORK RESTRICTIONS

- A. On-Site Work Hours: Work may be generally performed at the existing building during regular business hours, Monday through Friday, except as otherwise indicated. Other work hours may be negotiated between the Contractor and Owner, but such additional work periods are not guaranteed and are subject to change to accommodate Owner's use of the site.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION



8420 Meadowbridge Rd.  
Suite C.  
Mechanicsville, VA 23116  
O. 804-569-2473 F. 804-569-2950  
Class A Contractor #2705161752  
A Veteran-Owned Company

PROPOSAL No.: NG070225-00-00

COMPANY:	<u>Virginia Western Community College</u>	PERSON:	<u>Kevin Witter</u>
ADDRESS:	<u>3094 Colonial Avenue</u>	Phone No.:	<u>540-588-5760</u>
CITY/STATE	<u>Roanoke, VA</u>	BID DATE:	<u>07/02/2025</u>
JOB NAME:	<u>Renovate Chapman Hall Enrollment Center (budget)</u>		
JOB LOCATION:	<u>Roanoke, VA</u>	PRICE:	<u>\$23,900.00</u>
WRITTEN PRICE:	<u>Twenty-three thousand nine hundred dollars and no cents</u>		

Scope Change:

**PROPOSAL PRICING BASED ON VIRGINIA STATE CONTRACT # E194-90437 PRICING TERMS)**

**QUOTATION SCOPE:** Derived by Spectrum PC Design M001 – M402 dated 4-30-2025 (Budget Pricing)

**Confidential & Proprietary Information**

Contained within this proposal is **Confidential & Proprietary Information** belonging to BAS Control Systems LLC.; by requesting and receiving the proposal, the recipient agrees not to disclose any aspect of this proposal to any other company or any internal or external competing resources without the expressed written permission of BAS Control Systems.

SECTION	_____	PAGE	_____	THRU	_____	OF THE JOB SPECIFICATION.
SECTION	_____	PAGE	_____	THRU	_____	OF THE JOB SPECIFICATION.

**TERMS:** Special Terms/Progress billing

The standard terms and conditions of the sale are a part hereof.

ACCEPTED FOR:	_____	PROPOSED BY:	<b>BAS Control Systems</b>
BY:	_____	TITLE:	<u>Nick Gosslin</u> President
TITLE:	_____	APPROVED BY:	<u>Nick Gosslin</u>
DATE:	_____	TITLE:	<u>Nick Gosslin</u> President

NOTWITHSTANDING ANY INCONSISTENT OR ADDITIONAL TERMS THAT MAY BE EMBODIED IN YOUR PURCHASE ORDER, SELLER WILL ACCEPT YOUR ORDER SUBJECT ONLY TO THE TERMS OF THE WRITTEN CONTRACT BETWEEN US UNDER WHICH YOUR ORDER IS PLACED. IF NO SUCH CONTRACT EXISTS, SELLER WILL ACCEPT YOUR ORDER ONLY ON THE EXPRESS CONDITION THAT YOU ASSENT TO THE TERMS AND CONDITIONS CONTAINED AND A PART HEREOF, AND YOUR ACCEPTANCE AND RECEIPT OF THE GOODS SHIPPED HEREUNDER SHALL CONSTITUTE ASSENT TO SUCH TERMS

BAS Control Systems is pleased to provide all necessary installation labor and materials as outlined below.

We will upgrade the graphics on the existing server to include the new control points that have been added or changed. The graphics and programming will be installed on the current N4 server located on campus.

### **Chapman Hall Enrollment Center Scope:**

#### **1. Chapman Hall VAV demo and reinstall (7)**

- Provide labor to reinstall the existing VAV controllers recovered during the demo phase.
- Provide labor to reinstall the existing VAV discharge air sensors, recovered during the demo phase.
- Provide labor to reinstall the existing VAV space sensors, recovered during the demo phase.
- Provide labor to reinstall the existing VAV hot water valves recovered during the demo phase.
- Test and commission VAVs to ensure proper operation.

#### **2. Chapman Hall new VAVs (2)**

- Provide material and labor to install the VAV controllers for two new VAVs.
- Provide material and labor to install the VAV discharge air sensors for the two new VAVs.
- Provide material and labor to install the VAV space sensors for the two new VAVs.
- Provide material and labor to wire the VAV hot water valves (installation of valves by others).
- Test and commission VAVs to ensure proper operation.

#### **3. Exhaust Fan #3 Control**

- Provide material and labor to install the controls for EF3 Start/Stop.
- Provided material and labor to install the EF3 status device (CT).

#### **Installation Notes:**

- All work to be done at regular working hours, M-F, 7:30 am to 4:30 pm
- Disconnect and remove existing control cables and controllers from the eight existing VAV boxes. Save controllers to install on new units.
- Disconnect and remove cables and 2 existing space sensors to be relocated.
- Install cable via free air above accessible ceilings using cable supports and EMT in walls and where exposed or inaccessible. Rigid steel conduit is used for exterior or where required.
- Install MS/TP BACnet cable to each of the 9 VAV controllers.
- Install and wire BAS controllers and devices for listed equipment.
- Install and wire external sensors to include duct and space sensors as shown on the mechanical drawings details. Install control cables and devices for EF-3.
- Assist with programming, testing, and commissioning.

**THIS PROPOSAL DOES NOT INCLUDE:**

- Ethernet drop, supplied by Customer.
- Painting, patching, or other repairs to floors, walls, or ceilings
- Additional devices or materials not mentioned in this scope
- Any wiring of devices or equipment requiring 120 volts nominal and above.
- Overtime, weekends, holidays, or shift work hours
- Division 16, electrical work, G.C. work.
- Fire alarm work.
- Any rework caused by weather, fire, theft, vandalism, or other incidents.
- Access doors for accessibility to valves, dampers, electrical boxes, equipment, etc.

# CONDITIONS OF SALE

All goods, services, and Firmware furnished by BAS Control Systems ("Supplier") are governed by these standard terms and conditions, and every agreement or other undertaking by Supplier is expressly conditioned on assent hereto by the buyer, and any end-user with whom Supplier undertakes to deal, of Supplier's goods, services, and Firmware ("Customer"). These standard terms and conditions supersede all inconsistent printed terms submitted by the Customer before Supplier's order acknowledgment. They may be varied only by a typed or legibly handwritten notation on the face of Supplier's quotation or order acknowledgment, Customer's purchase order form, or similar documents. Product and sales policy sheets and the like published from time to time by Supplier shall supplement but not supersede these standard terms and conditions. SUPPLIER IS NOT BOUND TO FURNISH ITS GOODS, SERVICES, OR FIRMWARE EXCEPT IN ACCORDANCE WITH THE TERMS OF ITS ORDER ACKNOWLEDGMENT, FIRM QUOTATION, OR OTHER SIMILAR DOCUMENT ISSUED OVER THE SIGNATURE OF AN AUTHORIZED EMPLOYEE OR SUPPLIER, SUPPLIER'S REPRESENTATIVES, DISTRIBUTORS, DEALERS, AND OTHER NON-EMPLOYEES HAVE NO AUTHORITY TO BIND SUPPLIER.

1. **Firmware:** The term "goods" as used herein shall include Firmware which shall mean the set of instructions, consisting of symbolic language, processes, logic, routines, and programmed information in the form of firm or soft media relating to any of the goods and all revisions and modifications thereof.
2. **Price/Delivery Terms:** Unless otherwise provided on Supplier's order acknowledgment, price and delivery terms are FOB Supplier's plant and do not include sales, use, or other tSmartStruxurees. Supplier may, at its option, make partial shipments and invoices for the same.
3. **Payment/Credit/Security:** Payment terms for buyers with a credit standing deemed adequate by Supplier are Net 30 Days from the date of invoice. Supplier shall be entitled to charge interest thereafter at a rate permitted by law but in no event to exceed 1 1/2% per month. Whenever Supplier in good faith deems itself insecure, Supplier may cancel any outstanding contracts with Customer, revoke its extension of credit to Customer; reduce any unpaid debt by enforcing its security interest, created hereby, in all goods (and proceeds therefrom) furnished by Supplier to Customer; and take any other steps necessary or desirable to secure Supplier with respect to Customer's payment for goods and services furnished or to be furnished by Supplier.

In the event Customer for any reason withholds payment of any amount due Supplier, Supplier may declare itself insecure and suspend further shipment to Customer until Customer places the withheld amount in escrow and gives adequate security for further shipment or until Customer satisfies Supplier that Customer was entitled to withhold such amount. Supplier shall be entitled to recover from Customer all costs, including reasonable attorney's fees, incurred by Supplier in connection with the collection of any amount due Supplier.

4. **Cancellation of Customer:**
  - (a) Except as provided in subparagraph (b) below, Customer's wrongful non-acceptance or repudiation of a contract to purchase Supplier's goods or services shall entitle Supplier to recover the price or, where action for the price is not permitted by law, damages, as provided by law, including Supplier's lost profits. In this connection, all goods purchased and all services furnished by Supplier in complete or partial fulfillment of a special order from Customer shall be deemed identified to the contract between Supplier and Customer.
  - (b) Customer's wrongful non-acceptance or repudiation of a contract to purchase from Supplier goods which Supplier generally carries in inventory as stock items (or which are otherwise readily resalable by Supplier at a reasonable price) shall entitle Supplier to recover damages, as provided by law, including Supplier's lost profits.
5. **Warranty:** Supplier warrants that all new and unused goods furnished by Supplier are free from defect in workmanship and material as of the time and place of delivery by Supplier. Except for goods and services furnished by Supplier through its employees arising out of orders solicited by Supplier's Representatives and duly accepted by Supplier, Supplier does not warrant, and shall not be liable for, the quality of any goods or services furnished or to be furnished by representatives, distributors, dealers, or other non-employees of Supplier.

As a matter of general warranty policy, Supplier honors an original buyer's warranty claim in the event of failure, within 12 months from the day of delivery by Supplier to the site for BAS Control Systems equipment and for Building Management Systems goods, which have been installed and operated under normal conditions and in accordance with generally accepted industry practices. This general warranty policy may be expanded or limited for particular categories of products or customers by information sheets published by Supplier from time to time:

The express warranties provided above are in lieu of all other warranties, express, or implied. IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSES ARE EXCLUDED WITH RESPECT TO ANY AND ALL GOODS AND SERVICES FURNISHED BY SUPPLIER.

In the case of Supplier's breach of warranty or any other duty with respect to the quality of any goods, the sole and exclusive remedies therefore shall be, at Supplier's option, (1) repair, (2) replacement, or (3) payment of or credit for the purchase price (less reasonable depreciation based upon actual use) upon return of the non-conforming goods or parts.

Return authorization must be obtained from the Supplier before the return of any defective material. All unauthorized returns will be sent back, freight collect, to the Customer. All returns must be made with transportation prepaid by the Customer. Supplier's examination of the units must disclose to its satisfaction that defects exist and have not been caused by misuse, neglect, improper installation, repair, alteration, or accident before replacement is made or credit issued.

6. **Force Majeure:** Supplier and Customer assume the non-occurrence of the following contingencies which, without limitation, might render performance by Supplier impractical: strikes, riots, fires, war, late or non-delivery by suppliers to Supplier, and all other contingencies beyond the reasonable control of Supplier.
7. **No Consequential Damages:** Under no circumstances shall Supplier be liable to any person (including distributor) for loss of use, income, or profit or for incidental, special, or consequential or other similar damages, arising, directly or indirectly out of or occasioned by the sale, operation, use, installation, repair, or replacement of the goods or services, whether such damages are based on a claim of breach of express or implied warranties (including merchantability or fitness for a particular purpose), tortious conduit (including negligence and strict liability) or any other cause of action, except only in the case of personal injury where applicable law requires such liability.
8. **Governing Law:** The law of the Commonwealth of Virginia shall govern all transactions to which these standard terms and conditions apply.



8420 Meadowbridge Rd.  
Suite C.  
Mechanicsville, VA 23116  
O. 804-569-2473 F. 804-569-2950  
Class A Contractor #2705161752  
A Veteran-Owned Company

PROPOSAL No.: NG070225-00-00

COMPANY:	<u>Virginia Western Community College</u>	PERSON:	<u>Kevin Witter</u>
ADDRESS:	<u>3094 Colonial Avenue</u>	Phone No.:	<u>540-588-5760</u>
CITY/STATE	<u>Roanoke, VA</u>	BID DATE:	<u>07/02/2025</u>
JOB NAME:	<u>Renovate Chapman Hall Enrollment Center Lighting Controls (budget)</u>		
JOB LOCATION:	<u>Roanoke, VA</u>	PRICE:	<u>\$135,000.00</u>
WRITTEN PRICE:	<u>One hundred thirty-five thousand dollars and no cents</u>		

Scope Change:

**PROPOSAL PRICING BASED ON VIRGINIA STATE CONTRACT # E194-90437 PRICING TERMS)**

**QUOTATION SCOPE:** Derived by Spectrum PC Design E001 – E651 dated 6-30-2025 (Budget Pricing)

**Confidential & Proprietary Information**

Contained within this proposal is **Confidential & Proprietary Information** belonging to BAS Control Systems LLC.; by requesting and receiving the proposal, the recipient agrees not to disclose any aspect of this proposal to any other company or any internal or external competing resources without the expressed written permission of BAS Control Systems.

SECTION \_\_\_\_\_ PAGE \_\_\_\_\_ THRU \_\_\_\_\_ OF THE JOB SPECIFICATION.

SECTION \_\_\_\_\_ PAGE \_\_\_\_\_ THRU \_\_\_\_\_ OF THE JOB SPECIFICATION.

**TERMS:** Special Terms/Progress billing

The standard terms and conditions of the sale are a part hereof.

ACCEPTED FOR:	PROPOSED BY:	<b>BAS Control Systems</b>
BY:	TITLE:	Nick Gosslin President
TITLE:	APPROVED BY:	<i>Nick Gosslin</i>
DATE:	TITLE:	Nick Gosslin President

NOTWITHSTANDING ANY INCONSISTENT OR ADDITIONAL TERMS THAT MAY BE EMBODIED IN YOUR PURCHASE ORDER, SELLER WILL ACCEPT YOUR ORDER SUBJECT ONLY TO THE TERMS OF THE WRITTEN CONTRACT BETWEEN US UNDER WHICH YOUR ORDER IS PLACED. IF NO SUCH CONTRACT EXISTS, SELLER WILL ACCEPT YOUR ORDER ONLY ON THE EXPRESS CONDITION THAT YOU ASSENT TO THE TERMS AND CONDITIONS CONTAINED AND A PART HEREOF, AND YOUR ACCEPTANCE AND RECEIPT OF THE GOODS SHIPPED HEREUNDER SHALL CONSTITUTE ASSENT TO SUCH TERMS

BAS Control Systems is pleased to provide all necessary installation labor and materials as outlined below.

We will upgrade the graphics on the existing server to include the new control points that have been added or changed. The graphics and programming will be installed on the current N4 server located on campus.

### **Chapman Hall Enrollment Center Lighting Control Scope:**

#### **1. Chapman Hall Lighting Controls**

- Provide materials and labor for the installation of lighting controllers (14). These controllers will operate the lighting at low and high settings (to be determined by the owner).
- Provide materials and labor for the perimeter offices to use light harvesting. 22 harvesting sensors will provide automatic light leveling abilities to the spaces.
- Provide materials and labor to install 67 occupancy sensors for control of lights and receptacles.
- Provide labor to control 50% of all receptacles in the space by utilizing a wireless split-switching receptacle device (165). These receptacles will be operated by the BAS and scheduled according to the sequence of operation. Supply and Installation of these receptacles by Division 16. GFCIs are excluded from any BAS control strategies (stand-alone).
- Provided materials and labor to install light slider switches as located on the drawings. These switches will allow the user and the BAS to switch the lighting from “low” to High” (predetermined light level, adjustable).
- Provided materials and labor to install two button override switches located in the lobby area for the users to enable the lights and receptacles during after-hours time.
- Emergency lighting will remain on 24/7, but during normal power scenarios, the lights will be able to be switched from “Low/High”, but if normal power is lost, they will return to full power.
- Programming and testing will be done once all systems have been installed. Graphics will also be installed on the server to indicate the lighting status of all zones.
- Schedules will be created to allow the owner to adjust them as needed.

#### **Installation Notes:**

- All work to be done at regular working hours, M-F, 7:30 am to 4:30 pm
- Install cable via free air above accessible ceilings using cable supports. No conduit or surface raceway is included.
- Install MS/TP BACnet cable to each of the 14 BAS DDC controllers. Loop into the nearest existing BACnet trunk. Controllers are to be installed above ceilings in accessible areas near the rooms they serve.
- Install enclosures, DDC controllers, and power supplies. Wire BAS controllers to devices for listed equipment per BAS Control Drawings. 120 volts by others.
- Provide, install, and wire controls for new light fixtures. This includes 22 daylight sensors, 67 ceiling-mounted occupancy sensors, and 37 wall switches with 2-position dimming capabilities.
- Wire 53 relays for occupied area lighting enable. 120-volt lighting feeds by others.
- Install wireless transceivers for split duplex switched receptacles and wire network cable from the controller to the transceiver. Installation of receptacles by others. GFCI receptacles are exempt.
- Programming, testing, and commissioning.

**THIS PROPOSAL DOES NOT INCLUDE:**

- Ethernet drop, supplied by Customer.
- Painting, patching, or other repairs to floors, walls, or ceilings
- Additional devices or materials not mentioned in this scope
- Any wiring of devices or equipment requiring 120 volts nominal and above.
- Overtime, weekends, holidays, or shift work hours
- Division 16, electrical work, G.C. work.
- Fire alarm work.
- Any rework caused by weather, fire, theft, vandalism, or other incidents.
- Access doors for accessibility to valves, dampers, electrical boxes, equipment, etc.

# CONDITIONS OF SALE

All goods, services, and Firmware furnished by BAS Control Systems ("Supplier") are governed by these standard terms and conditions, and every agreement or other undertaking by Supplier is expressly conditioned on assent hereto by the buyer, and any end-user with whom Supplier undertakes to deal, of Supplier's goods, services, and Firmware ("Customer"). These standard terms and conditions supersede all inconsistent printed terms submitted by the Customer before Supplier's order acknowledgment. They may be varied only by a typed or legibly handwritten notation on the face of Supplier's quotation or order acknowledgment, Customer's purchase order form, or similar documents. Product and sales policy sheets and the like published from time to time by Supplier shall supplement but not supersede these standard terms and conditions. **SUPPLIER IS NOT BOUND TO FURNISH ITS GOODS, SERVICES, OR FIRMWARE EXCEPT IN ACCORDANCE WITH THE TERMS OF ITS ORDER ACKNOWLEDGMENT, FIRM QUOTATION, OR OTHER SIMILAR DOCUMENT ISSUED OVER THE SIGNATURE OF AN AUTHORIZED EMPLOYEE OR SUPPLIER, SUPPLIER'S REPRESENTATIVES, DISTRIBUTORS, DEALERS, AND OTHER NON-EMPLOYEES HAVE NO AUTHORITY TO BIND SUPPLIER.**

1. **Firmware:** The term "goods" as used herein shall include Firmware which shall mean the set of instructions, consisting of symbolic language, processes, logic, routines, and programmed information in the form of firm or soft media relating to any of the goods and all revisions and modifications thereof.
2. **Price/Delivery Terms:** Unless otherwise provided on Supplier's order acknowledgment, price and delivery terms are FOB Supplier's plant and do not include sales, use, or other tSmartStruxurees. Supplier may, at its option, make partial shipments and invoices for the same.
3. **Payment/Credit/Security:** Payment terms for buyers with a credit standing deemed adequate by Supplier are Net 30 Days from the date of invoice. Supplier shall be entitled to charge interest thereafter at a rate permitted by law but in no event to exceed 1 1/2% per month. Whenever Supplier in good faith deems itself insecure, Supplier may cancel any outstanding contracts with Customer, revoke its extension of credit to Customer; reduce any unpaid debt by enforcing its security interest, created hereby, in all goods (and proceeds therefrom) furnished by Supplier to Customer; and take any other steps necessary or desirable to secure Supplier with respect to Customer's payment for goods and services furnished or to be furnished by Supplier.

In the event Customer for any reason withholds payment of any amount due Supplier, Supplier may declare itself insecure and suspend further shipment to Customer until Customer places the withheld amount in escrow and gives adequate security for further shipment or until Customer satisfies Supplier that Customer was entitled to withhold such amount. Supplier shall be entitled to recover from Customer all costs, including reasonable attorney's fees, incurred by Supplier in connection with the collection of any amount due Supplier.

4. **Cancellation of Customer:**
  - (a) Except as provided in subparagraph (b) below, Customer's wrongful non-acceptance or repudiation of a contract to purchase Supplier's goods or services shall entitle Supplier to recover the price or, where action for the price is not permitted by law, damages, as provided by law, including Supplier's lost profits. In this connection, all goods purchased and all services furnished by Supplier in complete or partial fulfillment of a special order from Customer shall be deemed identified to the contract between Supplier and Customer.
  - (b) Customer's wrongful non-acceptance or repudiation of a contract to purchase from Supplier goods which Supplier generally carries in inventory as stock items (or which are otherwise readily resaleable by Supplier at a reasonable price) shall entitle Supplier to recover damages, as provided by law, including Supplier's lost profits.
5. **Warranty:** Supplier warrants that all new and unused goods furnished by Supplier are free from defect in workmanship and material as of the time and place of delivery by Supplier. Except for goods and services furnished by Supplier through its employees arising out of orders solicited by Supplier's Representatives and duly accepted by Supplier, Supplier does not warrant, and shall not be liable for, the quality of any goods or services furnished or to be furnished by representatives, distributors, dealers, or other non-employees of Supplier.

As a matter of general warranty policy, Supplier honors an original buyer's warranty claim in the event of failure, within 12 months from the day of delivery by Supplier to the site for BAS Control Systems equipment and for Building Management Systems goods, which have been installed and operated under normal conditions and in accordance with generally accepted industry practices. This general warranty policy may be expanded or limited for particular categories of products or customers by information sheets published by Supplier from time to time:

The express warranties provided above are in lieu of all other warranties, express, or implied. **IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSES ARE EXCLUDED WITH RESPECT TO ANY AND ALL GOODS AND SERVICES FURNISHED BY SUPPLIER.**

In the case of Supplier's breach of warranty or any other duty with respect to the quality of any goods, the sole and exclusive remedies therefore shall be, at Supplier's option, (1) repair, (2) replacement, or (3) payment of or credit for the purchase price (less reasonable depreciation based upon actual use) upon return of the non-conforming goods or parts.

Return authorization must be obtained from the Supplier before the return of any defective material. All unauthorized returns will be sent back, freight collect, to the Customer. All returns must be made with transportation prepaid by the Customer. Supplier's examination of the units must disclose to its satisfaction that defects exist and have not been caused by misuse, neglect, improper installation, repair, alteration, or accident before replacement is made or credit issued.

6. **Force Majeure:** Supplier and Customer assume the non-occurrence of the following contingencies which, without limitation, might render performance by Supplier impractical: strikes, riots, fires, war, late or non-delivery by suppliers to Supplier, and all other contingencies beyond the reasonable control of Supplier.
7. **No Consequential Damages:** Under no circumstances shall Supplier be liable to any person (including distributor) for loss of use, income, or profit or for incidental, special, or consequential or other similar damages, arising, directly or indirectly out of or occasioned by the sale, operation, use, installation, repair, or replacement of the goods or services, whether such damages are based on a claim of breach of express or implied warranties (including merchantability or fitness for a particular purpose), tortious conduit (including negligence and strict liability) or any other cause of action, except only in the case of personal injury where applicable law requires such liability.
8. **Governing Law:** The law of the Commonwealth of Virginia shall govern all transactions to which these standard terms and conditions apply.

SECTION 012500  
CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections include the following:
  - 1. Division 1 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on the appropriate DGS form or other form acceptable to the Owner.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
  - 2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change.
    - d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
  2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  4. Include costs of labor and supervision directly attributable to the change.
  5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  6. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.
- C. Proposal Request Form: Use appropriate DGS form or other form as acceptable to the Owner.

#### 1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on Form DGS-30-092 Contract Change Order.

#### 1.6 COSTS RELATED TO CHANGES IN THE WORK: The costs related to changes are to include:

- A. Labor including foreman.
- B. Materials entering permanently into the Work.
- C. The ownership or rental cost of construction plant and equipment during the time of use on the extra work.
- D. Power and consumable supplies for the operation of power equipment.
- E. Insurance and taxes.

- 1.7 CONTRACTORS' FEES: To the above cost there shall be added a fixed fee as stated below to the actual cost; this fee shall be compensation to cover the cost of supervision, overhead (including office personnel), bond, profit, and any other general expenses (such as hand tools, rental equipment, clean-up, trash removal, dump fees, etc.).
- A. If sub-subcontractor does actual work, markup (percentage due for overhead and profit) shall be a maximum of 10 percent. If subcontractor does not enter significantly into the work, he shall not add to cost. (No markup will be permitted for "pass-through" of invoices.) General Contractor's markup shall be a maximum of 5 percent.
  - B. If subcontractor does actual work, markup shall be a maximum of 10 percent. General contractor's markup shall be a maximum of 5 percent.
  - C. If General Contractor does actual work, markup shall be a maximum of 10 percent.
  - D. If sub-subcontractor does part of work, markup shall be a maximum of 5 percent of his direct work only. If subcontractor does part of work, markup shall be a maximum of 10 percent of his direct work only. General Contractor markup of subcontractor work shall be a maximum of 5 percent.
  - E. Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraphs 38.d, e and f of the General Conditions.
  - F. For cost credits to the project neither the General Contractor nor his subcontractor, nor his sub-contractor shall receive overhead and profit.

1.8 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on the appropriate DGS form or other form acceptable to the Owner. A Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.9 SPECIAL DIRECTIVES: BUILDING OFFICIALS

- A. When a change in the Scope of the Work appears necessary due to a comment made by a Building Official, Inspector or other local authority, the Contractor shall request written comment from such official citing the Code section for which a violation is noted. The Contractor shall forward this written comment to the Architect for review. If the Architect, in consultation with the official, deems that a change to the Work is

necessary, this change will be acted upon in the form of a Proposal Request as described above.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012700  
UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for unit prices.
- B. Related Sections include the following:
  - 1. Division 1 Section "Allowances" for procedures for using unit prices to adjust quantity allowances.
  - 2. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
  - 3. Division 1 Section "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

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

1.4 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A list of unit prices is included in the Bid Form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF UNIT PRICES

- A. Refer to Bid Form.

END OF SECTION

SECTION 012900  
PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Sections include the following:
  - 1. Division 1 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
  - 2. Division 1 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.

1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
  - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
    - a. Application for Payment forms with Continuation Sheets.
    - b. Submittals Schedule.
    - c. Contractor's Construction Schedule.
  - 2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
  - 3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
  - 1. Identification: Include the following Project identification on the Schedule of Values:
    - a. Project name and location.

- b. Name of Architect.
  - c. Architect's project number.
  - d. Contractor's name and address.
  - e. Date of submittal.
- 2. Submit draft of Schedule of Values and Certification for Payment Form DGS-30-104.
- 3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide several line items for principal subcontract amounts, where appropriate.
- 4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
- 5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
  - a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.
- 6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
- 7. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
- 8. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
  - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place shall be shown either as separate line items in the Schedule of Values.
- 9. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

#### 1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
  - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

- C. Payment Application Forms: Use Schedule of Values and Certification for Payment Form DGS-30-104 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
  - 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
  - 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
  - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- F. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
  - 1. List of subcontractors.
  - 2. Schedule of Values.
  - 3. Contractor's Construction Schedule (preliminary if not final).
  - 4. Submittals Schedule (preliminary if not final).
  - 5. Certificates of insurance and insurance policies.
  - 6. Performance and payment bonds.
- G. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
  - 1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
  - 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- H. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
  - 1. Evidence of completion of Project closeout requirements.
  - 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  - 3. Updated final statement, accounting for final changes to the Contract Sum.
  - 4. Form DGS-30-108, "Commonwealth of Virginia Affidavit of Payment Claims."
  - 5. Form DGS-30-136, "Certificate of Completion by Contractor."
  - 6. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013100  
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. Coordination Drawings.
  - 2. Administrative and supervisory personnel.
  - 3. Project meetings.
  - 4. Requests for Interpretation (RFIs).
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.
- C. Related Sections include the following:
  - 1. Division 1 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
  - 2. Division 1 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 3. Division 1 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.4 COORDINATION

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

4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
  1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  1. Preparation of Contractor's Construction Schedule.
  2. Preparation of the Schedule of Values.
  3. Installation and removal of temporary facilities and controls.
  4. Delivery and processing of submittals.
  5. Progress meetings.
  6. Preinstallation conferences.
  7. Project closeout activities.
  8. Startup and adjustment of systems.
  9. Project closeout activities.

## 1.5 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
  1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
    - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    - b. Indicate required installation sequences.
    - c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
  2. Sheet Size: At least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
  3. Number of Copies: Submit 6 opaque copies of each submittal, except for Division 15 and Division 16 submittals, submit 10 copies. Architect will return 4 (or 8 for Division 16 submittals).
    - a. Submit 10 copies where Coordination Drawings are required for operation and maintenance manuals. Architect will retain 4 copies; remainder will be returned. Mark up and retain one returned copy as a Project Record Drawing.

4. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
  1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

#### 1.6 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

- A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.
  1. Include special personnel required for coordination of operations with other contractors.

#### 1.7 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
  1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
  2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
  1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Phasing.
    - c. Critical work sequencing and long-lead items.
    - d. Designation of key personnel and their duties.
    - e. Procedures for processing field decisions and Change Orders.
    - f. Procedures for RFIs.

- g. Procedures for testing and inspecting.
  - h. Procedures for processing Applications for Payment.
  - i. Distribution of the Contract Documents.
  - j. Submittal procedures.
  - k. Preparation of Record Documents.
  - l. Use of the premises.
  - m. Work restrictions.
  - n. Owner's occupancy requirements.
  - o. Responsibility for temporary facilities and controls.
  - p. Construction waste management and recycling.
  - q. Parking availability.
  - r. Office, work, and storage areas.
  - s. Equipment deliveries and priorities.
  - t. First aid.
  - u. Security.
  - v. Progress cleaning.
  - w. Working hours.
3. Minutes: Record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
  - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. The Contract Documents.
    - b. Options.
    - c. Related RFIs.
    - d. Related Change Orders.
    - e. Purchases.
    - f. Deliveries.
    - g. Submittals.
    - h. Review of mockups.
    - i. Possible conflicts.
    - j. Compatibility problems.
    - k. Time schedules.
    - l. Weather limitations.
    - m. Manufacturer's written recommendations.
    - n. Warranty requirements.
    - o. Compatibility of materials.
    - p. Acceptability of substrates.
    - q. Temporary facilities and controls.
    - r. Space and access limitations.
    - s. Regulations of authorities having jurisdiction.
    - t. Testing and inspecting requirements.
    - u. Installation procedures.
    - v. Coordination with other work.
    - w. Required performance results.
    - x. Protection of adjacent work.

- y. Protection of construction and personnel.
  - 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  - 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
  - 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Conduct progress meetings at bi-weekly intervals. Coordinate dates of meetings with preparation of payment requests.
- 1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Review schedule for next period.
    - b. Review present and future needs of each entity present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Status of submittals.
      - 4) Deliveries.
      - 5) Off-site fabrication.
      - 6) Access.
      - 7) Site utilization.
      - 8) Temporary facilities and controls.
      - 9) Work hours.
      - 10) Hazards and risks.
      - 11) Progress cleaning.
      - 12) Quality and work standards.
      - 13) Status of correction of deficient items.
      - 14) Field observations.
      - 15) RFIs.
      - 16) Status of proposal requests.
      - 17) Pending changes.
      - 18) Status of Change Orders.
      - 19) Pending claims and disputes.
      - 20) Documentation of information for payment requests.
  - 3. Minutes: Record the meeting minutes.

4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
  - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- E. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
  1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to Combined Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    - b. Schedule Updating: Revise Combined Contractor's Construction Schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    - c. Review present and future needs of each contractor present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Status of submittals.
      - 4) Deliveries.
      - 5) Off-site fabrication.
      - 6) Access.
      - 7) Site utilization.
      - 8) Temporary facilities and controls.
      - 9) Work hours.
      - 10) Hazards and risks.
      - 11) Progress cleaning.
      - 12) Quality and work standards.
      - 13) Change Orders.
  3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

## 1.8 REQUESTS FOR INTERPRETATION (RFIs)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
  - 1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
  - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
  - 1. Project name.
  - 2. Date.
  - 3. Name of Contractor.
  - 4. Name of Architect.
  - 5. RFI number, numbered sequentially.
  - 6. Specification Section number and title and related paragraphs, as appropriate.
  - 7. Drawing number and detail references, as appropriate.
  - 8. Field dimensions and conditions, as appropriate.
  - 9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  - 10. Contractor's signature.
  - 11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
    - a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
- C. Hard-Copy RFIs: CSI Form 13.2A, or other form acceptable to the Owner.
  - 1. Identify each page of attachments with the RFI number and sequential page number.
- D. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above.
  - 1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- E. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow seven working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
  - 1. The following RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for coordination information already indicated in the Contract Documents.
    - d. Requests for adjustments in the Contract Time or the Contract Sum.
    - e. Requests for interpretation of Architect's actions on submittals.
    - f. Incomplete RFIs or RFIs with numerous errors.
  - 2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.

3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 1 Section "Contract Modification Procedures."
  - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
- G. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
  1. Project name.
  2. Name and address of Contractor.
  3. Name and address of Architect.
  4. RFI number including RFIs that were dropped and not submitted.
  5. RFI description.
  6. Date the RFI was submitted.
  7. Date Architect's response was received.
  8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1      GENERAL

- A. Report Coordination.
- B. Construction Schedule.
- C. Monthly Progress Reports.
- D. Submittal Schedule.
- E. Superintendent's Daily Progress Reports.
- F. Submissions.
- G. Distribution.

A. General & Supplemental Conditions.

B. Section 012900 – Payment Procedures.

1.4 **REPORT COORDINATION:** Coordinate both the listing and timing of reports and other activities required by provisions of this and other sections so as to provide consistency and logical coordination between reports. Maintain coordination and correlation between separate reports by updating at monthly or shorter time intervals.

- A. Contractor shall provide to the Architect a schedule for accomplishing the major portions of the work, prior to commencement of construction. Schedule shall make provisions for the limitations scheduled herein.
- B. The construction schedule shall be a comprehensive bar-chart type schedule indicating, by stage-coded symbols, a time bar for each major category or unit of work to be performed at the site; include minor elements of work involved in overall sequencing of the work. Arrange schedule to show graphically the major sequences of the work necessary for the completion of related elements of work. Arrange the schedule to show how substantial completion is scheduled to allow for the Architect's/Engineer's procedure for certification of substantial completion. Prepare the schedule on sheets of reproducible material to permit reproduction for the required distribution.

- C. Major elements of Work shall correspond exactly to breakdown of line items noted in the Schedule of Values.
- D. Superimpose an S-curve on the schedule to show the “precalculated” dollar-volume and “percent complete” against time at any point during Contract Time. Provide a double column of figures in left hand margins; one column shall indicate a range from zero dollars to the full Contract Sum, the other column shall indicate a percentage of work complete from zero to 100 percent. As the Work progresses and on each submittal which accompanies a payment request, plot a second dotted X-curve showing actual dollar-volume of Work performed and percentage complete.
- E. This schedule shall be a working document, which shall be maintained throughout the progress of the project. Revise and update the construction schedule to reflect significant changes on the construction time or sequence. Identify changes since previous version.

#### 1.6 MONTHLY PROGRESS REPORTS

- A. Progress reports shall include a revised construction schedule chart as a graphic representation of progress as indicated above.
- B. Show changes occurring since previous report.
  - 1. Major changes in scope.
  - 2. Activities modified since previous report.
  - 3. Revised projections of progress and completion.
  - 4. Other identifiable changes.
- C. Provide a narrative report to define:
  - 1. Problem areas, delays and their impact on the schedule.
  - 2. Corrective action recommended, and its effect.
  - 3. Status of submittals, change orders, etc.
- D. Provide final schedule as magnetic file and a hard copy substantial completion payment application allowing for punch list items and indicating owner occupancy.

#### 1.7 SUBMITTAL SCHEDULE

- A. Furnish a submittal schedule listing all items required to be submitted to the Architect for review. This schedule shall include all submittals required by the contract documents including all shop drawings, product data and other miscellaneous submittals (including “for information”).
- B. Schedule shall indicate item and specification section reference (where applicable), Contractor’s scheduled dates for submission to Architect and the required return date back to the Contractor. Schedule shall allow for a minimum of ten (10) calendar days for review of submittals by Architect after receipt.

- C. Submittal schedule shall be coordinated with the Construction schedule. Contractor shall revise and/or update the schedule to insure consistency with the Construction Schedule should it be revised. Submit revised schedules promptly. Failure to list any item in the Submittal Schedule or any revision thereto shall not be interpreted as relieving the Contractor of his obligation to comply with requirements of the Contract Documents.
- 1.8 SUPERINTENDENT'S DAILY PROGRESS REPORT: The form of the daily progress report shall be the Contractor's standard forms upon approval of the Architect, provided all of the required information is included. Prior to the commencement of the Work, submit a sample of the form intended for use. As a minimum, daily progress reports shall include:
- A. Contractors and subcontractors on site (company names) and number of personnel on site for each, with major activities in progress or planned for the day.
  - B. Temperature conditions at beginning and end of workday.
  - C. Accurate readings of total precipitation (in inches) and type of precipitation.
- 1.9 SUBMISSIONS: Architect will review schedules for information purposes only.
- A. Construction schedule: Promptly after award of contract and not less than 10 days prior to the submission of the first application for payment. Submit 2 copies to Architect.
  - B. Submittal schedule: Within 20 days after award of Contract. Submit updates with each Application for Payment. Application for payment will not be processed by Architect until revised schedule is submitted.
  - C. Submit monthly progress reports with each Application for Payment. Application for payment will not be processed by Architect until report is submitted.
  - D. Submit daily progress reports at the end of each week. Proper submission of accurate daily reports shall be a basis for any weather delay claims by the Contractor.
- 1.10 DISTRIBUTION
- A. Distribute 1 copy each of the schedules and progress reports to:
    - 1. Architect,
    - 2. Job site file, and
    - 3. All subcontractors.
  - B. Instruct recipients to report promptly to the Contractor any problems anticipated by the projections shown in the schedule.

PART 2      PRODUCTS (Not Used)

PART 3      EXECUTION (Not Used)

END OF SECTION

SECTION 013300  
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Sections include the following:
  - 1. Division 1 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
  - 2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
  - 3. Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
  - 4. Division 1 Section "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
  - 5. Division 1 Section "Closeout Procedures" for submitting warranties.
  - 6. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
  - 7. Division 1 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
  - 8. Divisions 2 through 16 Sections (or specifications on the Drawings) for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's and Construction Manager's responsive action.
- B. Informational Submittals: Written information that does not require Architect's and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

- A. General: Electronic copies of CAD Drawings of the Contract Drawings may be provided by Architect for Contractor's use in preparing submittals.
  - 1. Electronic CAD files will be available from the architect for \$100 per sheet.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- E. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
  2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
  3. Include the 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. Submittal number or other unique identifier, including revision identifier.
      - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).
    - i. Number and title of appropriate Specification Section.
    - j. Drawing number and detail references, as appropriate.
    - k. Location(s) where product is to be installed, as appropriate.
    - l. Other necessary identification.

- F. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
  - G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.
    - 1. Transmittal Form: Use AIA Document G810, or other form acceptable to the Owner.
    - 2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.
  - H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
    - 1. Note date and content of previous submittal.
    - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
    - 3. Resubmit submittals until they are marked either "No Exceptions Taken" or "Approved As Noted."
  - I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
  - J. Use for Construction: Use only final submittals with mark indicating either "No Exceptions Taken" or "Approved As Noted" by Architect.
  - K. Two (2) submittals will be considered for each product, material, or equipment. The Contractor will be liable to the Owner for costs incurred due to additional submittals provided that the additional submittals are required through no fault of the Owner or their agents or unless requested by the Architect. The cost of review by the Architect shall be determined by the Architect's current published hourly rate.
  - L. The Owner shall be involved in the selection and approval of all architectural/aesthetic items prior to release to Contractor for action.
- 1.5 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES
- A. General: At Contractor's written request, copies of Architect's CAD files will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:
    - 1. Contractor must provide written request to Architect with listing of specific drawings required.
    - 2. Contractor must sign a release form provided by Architect.
    - 3. Contractor must remit a fee to the Architect based on a lump sum amount per sheet requested.

## PART 2 - PRODUCTS

### 2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
  - 1. Submit electronic submittals directly to extranet specifically established for Project.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
  - 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
  - 2. Mark each copy of each submittal to show which products and options are applicable.
  - 3. Include the following information, as applicable:
    - a. Manufacturer's written recommendations.
    - b. Manufacturer's product specifications.
    - c. Manufacturer's installation instructions.
    - d. Standard color charts.
    - e. Manufacturer's catalog cuts.
    - f. Wiring diagrams showing factory-installed wiring.
    - g. Printed performance curves.
    - h. Operational range diagrams.
    - i. Mill reports.
    - j. Standard product operation and maintenance manuals.
    - k. Compliance with specified referenced standards.
    - l. Testing by recognized testing agency.
    - m. Application of testing agency labels and seals.
    - n. Notation of coordination requirements.
  - 4. Submit Product Data before or concurrent with Samples.
  - 5. Number of Copies: Submit 6 copies of Product Data (10 copies for Division 15 and 16), unless otherwise indicated. Architect will return 4 copies. Mark up and retain one returned copy as a Project Record Document.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal of Architect's CAD Drawings are otherwise permitted.
  - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Dimensions.
    - b. Identification of products.
    - c. Fabrication and installation drawings.
    - d. Roughing-in and setting diagrams.
    - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.

- f. Shopwork manufacturing instructions.
  - g. Templates and patterns.
  - h. Schedules.
  - i. Design calculations.
  - j. Compliance with specified standards.
  - k. Notation of coordination requirements.
  - l. Notation of dimensions established by field measurement.
  - m. Relationship to adjoining construction clearly indicated.
  - n. Seal and signature of professional engineer if specified.
  - o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
  3. Number of Copies: Submit 6 opaque copies of each submittal, unless copies are required for operation and maintenance manuals. Submit 10 copies where copies are required for operation and maintenance manuals (Division 15 and 16, and others as required). Architect will retain two copies; remainder will be returned. Mark up and retain one returned copy as a Project Record Drawing.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Number and title of appropriate Specification Section.
  3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    - a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
  4. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

- a. Number of Samples: Submit 4 sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project Record Sample.
    - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
    - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
  - 1. Type of product. Include unique identifier for each product.
  - 2. Number and name of room or space.
  - 3. Location within room or space.
  - 4. Number of Copies: Submit 6 copies of product schedule or list, unless otherwise indicated. Architect will return two copies.
    - a. Mark up and retain one returned copy as a Project Record Document.
- F. Application for Payment: Comply with requirements specified in Division 1 Section "Payment Procedures."

## 2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
  - 1. Number of Copies: Submit 6 copies of each submittal, unless otherwise indicated. Architect will not return copies.
  - 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
  - 3. Test and Inspection Reports: Comply with requirements specified in Division 1 Section "Quality Requirements."
- B. Coordination Drawings: Comply with requirements specified in Division 1 Section "Project Management and Coordination."
- C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

- E. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- F. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- G. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- J. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- K. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
  - 1. Name of evaluation organization.
  - 2. Date of evaluation.
  - 3. Time period when report is in effect.
  - 4. Product and manufacturers' names.
  - 5. Description of product.
  - 6. Test procedures and results.
  - 7. Limitations of use.
- L. Schedule of Tests and Inspections: Comply with requirements specified in Division 1 Section "Quality Requirements."
- M. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- N. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- O. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

- P. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 1 Section "Operation and Maintenance Data."
- Q. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- R. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
  2. Required substrate tolerances.
  3. Sequence of installation or erection.
  4. Required installation tolerances.
  5. Required adjustments.
  6. Recommendations for cleaning and protection.
- S. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
1. Name, address, and telephone number of factory-authorized service representative making report.
  2. Statement on condition of substrates and their acceptability for installation of product.
  3. Statement that products at Project site comply with requirements.
  4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  6. Statement whether conditions, products, and installation will affect warranty.
  7. Other required items indicated in individual Specification Sections.
- T. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- U. Construction Photographs: Comply with requirements specified in Division 1 Section "Photographic Documentation."
- V. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect, except as required in "Action Submittals" Article.
1. Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents, similar to the following: THE EQUIPMENT AND MATERIAL SHOWN AND MARKED IN THIS SUBMITTAL IS THAT PROPOSED TO BE INCORPORATED INTO THIS PROJECT, IS IN COMPLIANCE WITH THE CONTRACT DRAWINGS AND SPECIFICATIONS UNLESS OTHERWISE SHOWN IN BOLD FACE TYPE OR LETTERING AND LISTED ON A PAGE OR PAGES HEADED "DEPARTURES FROM DRAWINGS AND SPECIFICATIONS", AND CAN BE INSTALLED IN THE ALLOCATED SPACES. REVIEWED BY \_\_\_\_\_ Date \_\_\_\_\_

### 3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
  - 1. No Exceptions Taken: Fabrication may proceed based upon submittal.
  - 2. Approved As Noted: Fabrication may proceed based on corrections indicated, if any.
  - 3. Submit as Specified: The product submitted is rejected – resubmittal is required.
  - 4. Revise and Resubmit: Fabrication may not proceed, drawings must be revised and resubmitted.
  - 5. Where submittal is returned with notation for special processing or other activity, Contractor shall comply with notations indicated.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION

SECTION 014000  
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. 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-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Sections include the following:
  - 1. Division 1 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
  - 2. Division 1 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
  - 3. General notes and specifications for specific test and inspection requirements.

1.3 DEFINITIONS

- A. 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.
- B. Quality-Control Services: 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. Services do not include contract enforcement activities performed by Architect.
- C. 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 the standard by which the Work will be judged and are a separate panel from the Work.

- D. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
  - 1. Using a term 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 tradespeople of the corresponding generic name.

#### 1.4 CONFLICTING REQUIREMENTS

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

#### 1.5 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Description of test and inspection.
3. Identification of applicable standards.
4. Identification of test and inspection methods.
5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

## 1.6 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. 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.
- C. 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.

- D. Fabricator Qualifications: A firm experienced in producing products 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.
- E. 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 the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
  - 1. Requirement for specialists shall not supersede building codes and regulations governing the Work.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
  - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Factory-Authorized Service Representative Qualifications: An 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.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
  - 1. Contractor responsibilities include the following:
    - a. Provide test specimens representative of proposed products and construction.
    - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    - e. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
  - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to

Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
  2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
  3. Demonstrate the proposed range of aesthetic effects and workmanship.
  4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
    - a. Allow 15 days for initial review and each re-review of each mockup.
  5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  6. Demolish and remove mockups when directed, unless otherwise indicated.

#### 1.7 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
  2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  2. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspecting will be performed.
  3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."
- D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
  1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the 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 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 control by testing agency.
  7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
  1. Schedule times for tests, inspections, obtaining samples, and similar activities.

- H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for commencement of the Work.
  - 1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the 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 special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

### 3.2 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 the Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 014100  
TESTING SERVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Description.
- B. Testing Laboratories.
- C. Inspection Agencies.
- D. Inspectors.
- E. Laboratory Duties.
- F. Contractor Responsibilities.
- G. Coordination.
- H. Retest Responsibility.
- I. Distribution.

1.2 RELATED SECTIONS

- A. CO-7 General Conditions: Testing and approvals required by public authorities.
- B. Section 013300 – Submittal Procedures: Manufacturer's Certificates.
- C. Requirements for testing and the types of tests required are noted in the applicable specification Sections.

1.3 DESCRIPTION

- A. Required inspection and testing services are intended to assist in the determination of probable compliance of the Work with requirements specified or indicated.
- B. The Owner will employ and pay for the services of Independent Testing Laboratories or Inspection Agencies to perform specified inspection services and testing. Employment of the laboratory or agency shall in no way waive Contractor's obligations to perform the Work of the Contract.

#### 1.4 REFERENCES

- A. ASTM C802 - Practice for Conducting an Interlaboratory Test Program to Determine the Precision of Test Methods for Construction.
- B. ASTM C1021 - Practice for Laboratories Engaged in the Testing of Building Sealants.
- C. ASTM C1077 - Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
- D. ASTM D290 - Recommended Practice for Bituminous Mixing Plant Inspection.
- E. ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- F. ASTM D4561 - Practice for Quality Control Systems for an Inspection and Testing Agency for Bituminous Paving Materials.
- G. ASTM E329 - Practice for Use in the Evaluation of Inspection and Testing Agencies as Used in Construction.
- H. ASTM E543 - Practice for Determining the Qualification of Nondestructive Testing Agencies.
- I. ASTM E548 - Practice for Preparation of Criteria for Use in the Evaluation of Testing Laboratories and Inspection Bodies.
- J. ASTM E699 - Practice for Criteria for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating Building Components in Accordance with Test Methods Promulgated by ASTM Committee E6.

#### 1.5 TESTING LABORATORIES AND INSPECTION AGENCIES

- A. Meet "Recommended Requirements for Independent Laboratory Qualification" published by American Council of Independent Laboratories.
- B. Meet basic requirements of applicable ASTM Standards of Recommended Practice for Inspection and Testing Agencies listed above for Product specified for testing in individual Sections.
- C. Be authorized to operate in the State in which the Project is located.
- D. Calibrate testing equipment at reasonable intervals by devices of accuracy traceable to the National Bureau of Standards.

## 1.6 LABORATORY DUTIES

- A. Cooperate with Architect and Contractor; provide qualified personnel after due notice.
- B. Perform specified inspections, sampling and testing of materials per specified standards to verify compliance with requirements of Contract Documents.
- C. Immediately notify Architect (by telephone) and Contractor (in person at the site) of observed irregularities or deficiencies of Work or products or of its acceptability if no deficiencies are observed.
- D. Report by telephone to the Architect, at the end of each day that inspection and testing is accomplished. This verbal report shall include the same elements as the written report described below, and when verbally approved will allow the work to proceed.
- E. Verbal reports shall be promptly followed within 72 hours by a written report of each test and inspection to the Contractor with a copy to the Architect. Each report shall include:
  - 1. date issued;
  - 2. project title and number;
  - 3. testing agency name, address and telephone number;
  - 4. name and signature of inspector;
  - 5. date and time of sampling or inspection;
  - 6. record of temperature and weather conditions;
  - 7. date of test;
  - 8. identification of product and Specification Section;
  - 9. location of sample or test in the Project;
  - 10. type of inspection or test;
  - 11. results of test and compliance with Contract Documents;
  - 12. interpretation of test results, when requested by Architect.
- F. Laboratory or agency is not authorized to reduce, release, revoke, alter or enlarge on requirements of Contract Documents, approve, accept, or stop any portion of the Work or assume or perform any duties of the Contractor.

## 1.7 CONTRACTOR'S RESPONSIBILITIES

- A. Cooperate with agency personnel, provide access to Work.
- B. Secure and deliver to the laboratory adequate quantities of representative samples of materials, proposed mix designs, etc, proposed to be used and which require testing.
- C. Furnish copies of product test reports as required.

- D. Furnish incidental labor and facilities to provide access to Work to be tested, to obtain and handle samples at the Project site or at the source of the product to be tested, to facilitate inspections and tests and for storage and curing of test samples.
  - E. Notify agency sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.
- 1.8 COORDINATION: The Contractor and each independent agency engaged to perform inspections, tests and similar services for the project shall coordinate the sequence of their activities so as to accommodate required services and to avoid delay in the progress of the Work.
- 1.9 RE-TEST RESPONSIBILITY:
- A. Where results of inspections, tests or similar services prove unsatisfactory and do not indicate compliance of the Work with the requirements of the Contract Documents, the expense of retesting/reinspection is the responsibility of the Contractor, regardless of whether the original test was the Contractor's responsibility. This includes inspections made by any of the design team (architect, engineer, landscape architect, etc.), in addition to independent testing or inspection services.
  - B. Testing of Work revised or replaced by the Contractor is the Contractor's responsibility, where testing was required for the original Work.
- 1.10 DISTRIBUTION: A minimum of one (1) copy of all testing and inspection reports by the testing laboratory will be sent to Architect, Owner, and Contractor.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

## SECTION 014200 REFERENCES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": 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.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

#### 1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

- B. Publication Dates: Comply with edition of standards as referenced in Virginia Uniform Statewide Building Code (VaUSBC). For standards not referenced in VaUSBC, comply with edition in effect as of date of the Contract Documents, unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
  - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.
- D. Abbreviations and Acronyms for Standards, Regulations and Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations as stipulated by the Architect. They are not bound with the Contract Documents. Names, telephone numbers, and website addresses are available from the Architect, and are believed to be accurate and up-to-date as of the date of the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 014210  
INSPECTION SERVICES

PART 1 - GENERAL:

1.01 DESCRIPTION:

A. Work Included:

The Contractor shall coordinate the work with the Owner's inspector(s) and assist the inspector during the course of this project.

B. Work Not Included:

1. The Owner shall engage the service of an experienced inspector(s) to inspect the construction, to verify the proper installation of related work, and to ensure full compliance with the Contract specifications.

1.02 QUALITY ASSURANCE:

- A. Conduct daily inspection of all work in process.
- B. Conduct daily inspection, and more often if necessary, to verify that the manufacturer's recommendations are being met for the storage and protection of materials.
- C. Prior to each day's work, carefully review and coordinate all aspects of the construction with the installation of new work in a manner that prevents the advanced removal of these protective devices prior to planned replacement.
- D. Coordinate the work with Owner's inspector(s) by notifying the inspector of scheduled work in advance.
- E. Daily inspect the project to verify that all packaging materials, waste, debris, and other trash is removed at the end of each workday.
- F. Daily inspect the area to verify that all means of access to the project by unauthorized personnel, including but not necessarily limited to ladders, scaffolds and material lifting equipment have been removed or rendered harmless to unauthorized personnel.
- G. The Contractor shall verify that all products are applied only by applicators approved by the manufacturer.
- H. The Contractor shall verify that detrimental amounts of moisture that may be present from wet insulation, adverse weather conditions or other sources of moisture are removed prior to installation.

## PART 2 - EXECUTION:

### 2.01 COORDINATION:

- A. The Contractor shall coordinate his work with that of the Owner's inspector(s) to assure proper and adequate installation and compliance with the requirements of this specification.
- B. The Contractor shall notify the inspector(s) at least 24 hours prior to a scheduled workday. In the event the Contractor notifies the inspector of a scheduled workday and no work is performed, the Contractor shall pay the actual costs of the inspector for such days not worked. The Contractor shall be billed for a minimum of four (4) hours at the inspector's rate.

### 2.02 PRE-CONSTRUCTION MEETING:

- A. Not less than three (3) nor more than thirty (30) days prior to the scheduled start of installation, an inspection and pre-construction meeting shall be conducted at the job site.
  - 1. Except as otherwise directed by the A/E, the A/E will be chairperson of the meeting, will take minutes of meeting and will record all agreements reached as a result of the inspection and meeting.
  - 2. The Contractor, A/E and any other interested parties shall visually inspect all areas upon which construction is scheduled to be started.
    - a. Determine general acceptability and determine areas requiring further preparation.
    - b. Determine acceptable remedies for unacceptable areas.
  - 3. Discuss proposed schedule for construction, and reach agreement as to the date of start of work.
  - 4. Discuss proposed methods for construction and equipment and personnel to be used.
  - 5. Discuss inspection methods to be used, reports to be issued by the Owner's inspector(s), responsibilities and limits of responsibilities of the Contractor, inspector, and A/E. Discuss potential problems arising from use of methods not agreed to in this pre-construction meeting.
  - 6. The form E & B CO-12 Schedule of Values and Certificate for Payment, shall be provided by the Contractor to the Architect/Engineer. It shall be broken down into a sufficient level of detail to allow the A/E to verify the work completed. When the Contractor intends to bill for stored materials, the Schedule of Values for the applicable trades shall be divided into labor and materials. This break down Schedule of Values shall be submitted at the pre-construction meeting for approval by the A/E.

## 2.03 INSPECTIONS AND TESTING DURING CONSTRUCTION:

- A. The Contractor shall cooperate with and assist the Owner's inspector(s) in verifying that materials delivered to the job site as those approved by the A/E for use on this work.
- B. The Contractor shall provide the Owner's inspector(s) access to the work during construction for the purpose of observing the installation and insuring compliance requirements of this specification including, but not necessarily limited to:
  - 1. Verify use of installation procedures agreed upon in the pre-construction meeting.
  - 2. Report to the Contractor's representative on the job unacceptable methods or results when observed.
  - 3. Report to the Owner and to the A/E if the Contractor fails to correct unacceptable methods or unacceptable results.
- C. Preliminary Inspection:

The Owner's inspector(s) or project A/E shall conduct a visual inspection of the entire project for the purpose of identifying work requiring correction prior to final inspection:

- 1. Compile a list of items required to be reviewed, replaced or repaired.
  - 2. Deliver a copy of the list to the A/E and Contractor and to others as appropriate.
  - 3. Verify proper revision or replacement of all items on the list.
- D. Final Inspection:

Final inspection shall be conducted after all work is completed and a satisfactory preliminary inspection is completed. Prior to this inspection, the Contractor shall furnish to the Owner the required guarantee and warranty. The Contractor shall have a representative present for this final inspection.

END OF SECTION

SECTION 015000  
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General Conditions, Special Conditions and Division 1 - Specifications Sections, apply to work of this section.

1.02 DESCRIPTION:

A. Work Included:

Provide temporary facilities and controls needed for the work including, but not necessarily limited to the following:

1. Sanitary facilities.
2. Enclosures such as tarpaulins, barricades, canopies and safety signage.
3. Require that all shut downs not only be coordinated with VWCC but that they occur nights or weekends on our approved/agreed upon schedule.
4. For fire hazards during demolition and construction, the provisions of the 2021 International Fire Code (Chapter 33) shall be strictly observed.
5. For conditions not covered by the IFC, comply with NFPA 241-2019.
6. The requirements of the Virginia Existing Building Code (VEBC) and the International Fire Code (IFC) shall be strictly observed to safeguard against all fire hazards attendant upon construction operations.

B. Related Work and Documents:

1. Equipment furnished by sub-contractors shall comply with the requirements of safety regulations. Equipment normally furnished by the individual trades in execution of their own portions of the work are not part of this section.
2. Permanent installation and hookup of the various utilities lines are not described in this section.
3. Acceptance by the Contractor of the use of the Owner's utilities constitutes a release to the Owner of any and all liability to the Contractor for whatever damages resulting from utility outages, including damages from loss of services and voltage variations.
4. Safety signage is mandatory for this project. Coordinate with Owner on location of signage.

### 1.03 PRODUCT HANDLING:

Maintain temporary facilities and controls in proper and safe condition throughout progress of the work.

## PART 2 - PRODUCTS

### 2.01 UTILITIES:

#### A. Water:

Water, if required for work under the contract, will be furnished by the Owner subject to reasonable use by the Contractor, only to the extent and capacity of present services.

B. The Contractor shall provide temporary fencing, barricades and other barriers as needed to protect the public from the construction operations. During renovations in occupied buildings, all means necessary to ensure safety and protect the public from the construction operations shall be taken by the Contractor.

C. The Contractor shall maintain existing utility systems in full or partial operation during construction. These shall include but not be limited to water, sanitary sewer, natural gas, electrical, telephone, data and storm sewers. In instances when temporary disruptions are required to make connections, the Contractor shall schedule such work to be done during a time that facilities served by the utility are unoccupied, as approved by the Owner. A minimum notice of 5 days shall be given to the Owner prior to shutdown. The same consideration shall be provided with regard to the operation of electrical, mechanical and other building systems in adjacent buildings.

D. Temporary Facilities and Controls: Contractor shall provide and maintain all temporary facilities for the duration of the project. Temporary facilities shall include:

1. Construction fencing a minimum 6'-0" high, in an area designated by the Owner. The designated construction area shall be fully enclosed and secure from traffic and pedestrians. The construction trailer, staging, storage and all other Contractor support services shall be located within the construction fencing.
2. Sanitary facilities for use by all construction workers. Sanitary facilities shall be emptied and maintained on a regular basis.
3. Exterior enclosures required for work in and around existing occupied structures shall be maintained constantly to prevent excesses in temperature, precipitation, construction debris, pedestrians and animals from entering the structure. All doors shall be self-closing and lockable.

4. Interior enclosures required for work existing occupied spaces shall be maintained constantly to prevent construction debris and pedestrians from entering the construction area.
5. Contractor shall provide waste removal services as required to maintain the site in a clean and orderly condition. Remove trash from site daily. All noxious and odorous products shall be securely contained and stored away from occupied buildings.
6. Provide protection of all existing and new work. Refer to individual section specifications for additional information.
7. Contractor is responsible to remove all temporary facilities and controls, including temporary utilities. Clean site thoroughly, and restore all damaged pavement, curbing, landscaping, and sod as noted in other specification sections.

## 2.02 TEMPORARY FACILITIES:

### A. Sanitary Facilities:

1. Provide temporary sanitary facilities in the quantity required for use by all Contractor personnel.
2. Maintain all temporary sanitary facilities in a clean, serviceable, and sanitary condition at all times.

## PART 3 - EXECUTION

### 3.01 MAINTENANCE AND REMOVAL:

- A. Maintain temporary facilities and controls as long as needed for safe and proper completion of the work.
- B. Remove such temporary facilities and controls as soon as the progress of the work will permit, or as directed by the A/E.

END OF SECTION

SECTION 016000  
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. Related Sections include the following:
  - 1. Division 1 Section "Alternates" for products selected under an alternate.
  - 2. Division 1 Section "References" for applicable industry standards for products specified.
  - 3. Division 1 Section "Closeout Procedures" for submitting warranties for Contract closeout.
  - 4. Divisions 2 through 33 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
  - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

#### 1.4 SUBMITTALS

- A. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
  - 1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
  - 2. Form: Tabulate information for each product under the following column headings:
    - a. Specification Section number and title.
    - b. Generic name used in the Contract Documents.
    - c. Proprietary name, model number, and similar designations.
    - d. Manufacturer's name and address.
    - e. Supplier's name and address.
    - f. Installer's name and address.
  - 3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 6 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
    - a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
  - 4. Completed List: Within 60 days after date of commencement of the Work, submit 6 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
  - 5. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.
- B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use CSI Form 13.1A.
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified material or product cannot be provided.
    - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and

- separate contractors, that will be necessary to accommodate proposed substitution.
- c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - e. Samples, where applicable or requested.
  - f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
  - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
  - h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
  - i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
  - j. Cost information, including a proposal of change, if any, in the Contract Sum.
  - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
  - l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 15 days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
    - a. Form of Acceptance: Change Order.
    - b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.
- C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
    - a. Form of Approval: As specified in Division 1 Section "Submittal Procedures."

- b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.
- D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

## 1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
  - 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
  - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

## 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
  - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. 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.
  - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- C. Storage:
  - 1. Store products to allow for inspection and measurement of quantity or counting of units.
  - 2. Store materials in a manner that will not endanger Project structure.
  - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
  - 4. Store cementitious products and materials on elevated platforms.
  - 5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
  - 6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
  - 7. Protect stored products from damage and liquids from freezing.

8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

## 1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
  1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
  2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
  1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
- C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
  1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
  4. Where products are accompanied by the term "as selected," Architect will make selection.
  5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
  6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
  7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in

Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
2. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
3. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
4. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.

## 2.2 PRODUCT SUBSTITUTIONS

- A. Timing: Architect will consider requests for substitution if received within 60 days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.
- B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.

## 2.3 COMPARABLE PRODUCTS

- A. Conditions: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.

2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017000  
EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. Project Coordination.
  - 4. General installation of products.
  - 5. Coordination of Owner-installed products.
  - 6. Progress cleaning.
  - 7. Starting and adjusting.
  - 8. Protection of installed construction.
  - 9. Correction of the Work.
- B. Related Sections include the following:
  - 1. Division 1 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
  - 2. Division 1 Section "Submittal Procedures" for submitting surveys.
  - 3. Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Permitting:
  - 1. Building Permit: The Owner will provide a Building Permit issued by the State. Contractor shall not begin until permit is provided and Owner authorization given.
- B. Existing Conditions: The existence and location of site improvements, utilities, ground elevations and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of all underground utilities and their elevations and other construction affecting the Work.

1. Before construction, verify the location and points of connection of utility services, if required.
- C. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
  1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
  2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- D. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
    - a. Description of the Work.
    - b. List of detrimental conditions, including substrates.
    - c. List of unacceptable installation tolerances.
    - d. Recommended corrections.
  2. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility, Architect and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

### 3.3 PROJECT COORDINATION

- A. Coordinate scheduling, submittals, and Work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Make minor adjustments in location of piping and equipment as may be necessary for structural or construction difficulties; no extras will be allowed for such minor changes.
- C. Report immediately any discrepancies, or errors and omissions in the Contract Documents to the Architect. Do not proceed with any related work until written instructions have been issued by the Architect for any change required to achieve coordination.
- D. All work shall be installed in cooperation with all subcontractors, sub-subcontractors and material suppliers. Investigate interrelated conditions in the work and make proper provisions to avoid interference before beginning of fabrication or installation of materials. All changes to the work caused by the Contractor's neglect of these requirements shall be made by him at his expense.
- E. Anchors, sleeves, inserts and supports required or necessary for the work shall be fully coordinated and compatible with all related equipment and materials.
- F. Locate all slots, chases, openings and recesses through floors, walls, ceilings, and roofs required for proper installation of the work prior to construction.
- G. The Architect may require the General Contractor to remove and rework, or relocate, uncoordinated work to facilitate the proper function, installation and location of the work.
- H. Contractor acknowledges that, even though Contract Documents may not be perfectly coordinated, his contract price includes all work reasonably inferable from any of the Contract Documents and he shall make all building components function in the manner intended.
- I. The Contract Documents have been classified according to discipline for convenience only, and such classification shall not be construed as stipulating which contractor, subcontractor, or personnel shall complete the Work. Items shown on Architectural drawings and not shown on Structural, Civil, Mechanical, Plumbing and/or Electrical drawings (and vice versa) shall be provided by the Contractor as though they were shown on all applicable drawings. Contact the Architect for clarification as required.

### 3.4 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.

- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels. Coordinate with Owner to determine off-hour periods when excessively noisy work is required.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.5 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
  - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  - 2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
  - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  - 1. Remove liquid spills promptly.
  - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Burying or burning waste materials on-site will not be permitted except for concrete rubble where indicated and as limited by size and consistency. Washing waste materials down sewers or into waterways will not be permitted.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.6 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

### 3.7 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

END OF SECTION

SECTION 017310  
CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Related Sections include the following, if applicable to this project:
  - 1. Divisions 2 through 33 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
  - 2. Division 7 Section "Through-Penetration Firestop Systems" for patching fire-rated construction.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:
  - 1. Primary operational systems and equipment.
  - 2. Air or smoke barriers.
  - 3. Mechanical systems piping and ducts.
  - 4. Electrical wiring systems.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in

reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:

1. Water, moisture, or vapor barriers.
  2. Membranes and flashings.
  3. Equipment supports.
  4. Piping, ductwork, vessels, and equipment.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

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

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

### 3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  - 4. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
  - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
  - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.
  - 3. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  - 4. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

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

END OF SECTION

SECTION 017700  
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
1. Inspection procedures.
  2. Warranties.
  3. Final cleaning.
  4. Contractor's Closeout Submittals.
- B. Related Sections include the following:
1. Division 1 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
  2. Division 1 Section "Execution Requirements" for progress cleaning of Project site.
  3. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
  4. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  2. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  3. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  4. Complete final cleaning requirements, including touchup painting.
  5. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion

after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected. Refer to the General Conditions regarding re-inspection fees.
2. Results of completed inspection will form the basis of requirements for Final Completion.

#### 1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
  1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
  2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Instruct Owner's personnel in maintenance of products and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
  1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected. Refer to the General Conditions regarding re-inspection fees.

#### 1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit 6 copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
  1. Organize list of spaces in sequential order.
  2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
  3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Contractor.

- e. Page number.

## 1.6 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
  - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2 by 11-inch paper.
  - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

## 1.7 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ARCHITECT

- A. Evidence of compliance with requirements of governing authorities, including Certificate of Occupancy, Certificates of Inspection, elevator inspection certificates, domestic water system inspection certificates.
- B. Project Record Documents: Refer to requirements of Section 01781 – Project Record Documents.
- C. Operation and Maintenance Data: Refer to requirements of Section 01782 – Operating and Maintenance Data.
- D. Warranties: Refer to requirements for Warranties in this section.
- E. Evidence of Payment and Release of Liens: Refer to requirements of Conditions of the Contract.
- F. Certificate of Insurance for Products and Complete Operations.

## 1.8 FINAL ADJUSTMENTS OF ACCOUNTS

- A. Submit a final statement of accounting to Architect.

- B. Statement shall reflect all adjustment to the Contract Sum:
  - 1. The original Contract Sum.
  - 2. Additions and deductions resulting from previous Change Orders, Deductions for uncorrected Work, Deductions for re-inspection payments, Other adjustments.
  - 3. Final statement of accounting of all allowances.
  - 4. Total Contract Sum, as adjusted.
  - 5. Sum remaining due.
- C. Architect will prepare a final Change Order, reflecting approved adjustments, which were not previously made by Change Orders.

## 1.9 FINAL APPLICATION FOR PAYMENT

- A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

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

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations (for areas within the limits of the Project site) before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

- d. Remove tools, construction equipment, machinery, and surplus material from Project site.
  - e. Clean exposed hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
  - f. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
  - g. Replace parts subject to unusual operating conditions.
  - h. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs.
  - i. Leave Project clean and ready for occupancy.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION

SECTION 017810  
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
  - 1. Record Drawings.
  - 2. Record Product Data.
- B. Related Sections include the following:
  - 1. Division 1 Section "Closeout Procedures" for general closeout procedures.
  - 2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
  - 3. Divisions 2 through 33 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit copies of Record Drawings as follows:
    - a. Final Submittal: Submit one set(s) of original marked-up Record Prints. Print each Drawing, whether or not changes and additional information were recorded.
- B. Record Product Data: Submit 3 copies of each Product Data submittal.
  - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of black-line white prints of the Contract Drawings and Shop Drawings.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an understandable drawing technique.
    - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
  2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Depths of foundations.
    - d. Locations and depths of underground utilities.
    - e. Revisions to routing and sizes of ducts, piping and conduits.
    - f. Revisions to electrical circuitry.
    - g. Actual equipment locations.
    - h. Changes made by Change Order or Construction Change Directive.
    - i. Changes made following Architect's written orders.
    - j. Details not on the original Contract Drawings.
    - k. Field records for variable and concealed conditions.
    - l. Record information on the Work that is shown only schematically.
  3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
  4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing Record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
  2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Identification: As follows:
  - a. Project name.
  - b. Date.
  - c. Designation "PROJECT RECORD DRAWINGS."
  - d. Name of Architect.
  - e. Name of Contractor.

## 2.2 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  3. Note related Change Orders and Record Drawings where applicable.

## 2.3 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

# PART 3 - EXECUTION

## 3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION

SECTION 017820  
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory.
  - 2. Maintenance manuals for the care and maintenance of products, materials, finishes, systems and equipment.
- B. Related Sections include the following:
  - 1. Division 1 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
  - 2. Division 1 Section "Closeout Procedures" for submitting operation and maintenance manuals.
  - 3. Division 1 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
  - 4. Divisions 2 through 26 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

- A. Final Submittal: Submit 3 copies of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.
  - 1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

## 1.5 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

## PART 2 - PRODUCTS

### 2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

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

### 2.2 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  - 1. Title page.
  - 2. Table of contents.
  - 3. Manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
  - 1. Subject matter included in manual.
  - 2. Name and address of Project.
  - 3. Name and address of Owner.
  - 4. Date of submittal.
  - 5. Name, address, and telephone number of Contractor.

6. Name and address of Architect.
  7. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
  2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
  3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
  4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
  5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

## 2.3 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions.

2. Performance and design criteria if Contractor is delegated design responsibility.
  3. Operating standards.
  4. Operating procedures.
  5. Operating logs.
  6. Wiring diagrams.
  7. Control diagrams.
  8. Piped system diagrams.
  9. Precautions against improper use.
  10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number.
  2. Manufacturer's name.
  3. Equipment identification with serial number of each component.
  4. Equipment function.
  5. Operating characteristics.
  6. Limiting conditions.
  7. Performance curves.
  8. Engineering data and tests.
  9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
  2. Equipment or system break-in procedures.
  3. Routine and normal operating instructions.
  4. Regulation and control procedures.
  5. Instructions on stopping.
  6. Normal shutdown instructions.
  7. Seasonal and weekend operating instructions.
  8. Required sequences for electric or electronic systems.
  9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

## 2.4 PRODUCT MAINTENANCE MANUAL

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
1. Product name and model number.
  2. Manufacturer's name.

3. Color, pattern, and texture.
  4. Material and chemical composition.
  5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
  2. Types of cleaning agents to be used and methods of cleaning.
  3. List of cleaning agents and methods of cleaning detrimental to product.
  4. Schedule for routine cleaning and maintenance.
  5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

## 2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard printed maintenance instructions and bulletins.
  2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  3. Identification and nomenclature of parts and components.
  4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
  2. Troubleshooting guide.
  3. Precautions against improper maintenance.

4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  5. Aligning, adjusting, and checking instructions.
  6. Demonstration and training videotape, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

## PART 3 - EXECUTION

### 3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
  - 1. Do not use original Project Record Documents as part of operation and maintenance manuals.
  - 2. Comply with requirements of newly prepared Record Drawings in Division 1 Section "Project Record Documents."
- F. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

## SECTION 019113 COMMISSIONING

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Commissioning description.
  - 2. Submittals.
  - 3. Commissioning services.
  - 4. Commissioning responsibilities.
  - 5. Commissioning meetings.
  - 6. Commissioning reports.
  - 7. Test equipment.
  - 8. Verification check and startup procedures.
  - 9. Functional performance test procedures.
  - 10. Function performance test methods.
  - 11. Deficiencies and test approvals.
  - 12. Demonstration.
- B. Related Sections:
  - 1. Section 230813 – Mechanical Systems Commissioning: Mechanical systems commissioning requirements.

#### 1.2 REFERENCES

- A. Associated Air Balance Council:
  - 1. AABC - AABC Commissioning Guideline.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
  - 1. ASHRAE Guideline 1 - The HVAC Commissioning Process.
- C. National Environmental Balancing Bureau:
  - 1. NEBB - Procedural Standards for Building Systems Commissioning.

#### 1.3 COMMISSIONING DESCRIPTION

- A. Commissioning: Systematic process of ensuring systems perform interactively according to design intent and Owner's operational needs. Commissioning process encompasses and coordinates system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training, and verification of actual performance.
- B. Commissioning Intent:
  - 1. Verify equipment and systems are installed in accordance with manufacturer's instructions, industry accepted minimum standards, and Contract Documents.

2. Verify equipment and systems receive adequate operational checkout by Contractor.
  3. Verify and document proper performance of equipment and systems.
  4. Verify complete operation and maintenance documentation is delivered to Owner.
  5. Verify Owner's operating personnel are adequately trained.
- C. Equipment and Systems to Be Commissioned: Refer to Section 230813 for equipment and system lists.
- D. Commissioning does not relieve Contractor of responsibility to provide finished and fully functioning Project.
- E. Commissioning Process Overview and General Order of Commissioning Tasks:
1. Commissioning begins with initial commissioning meeting.
  2. Conduct progress commissioning meetings throughout construction, to plan, scope, coordinate, schedule future activities and resolve problems.
  3. Equipment documentation is submitted to Commissioning Authority during normal submittals, with detailed start-up procedures.
  4. Contractor and equipment and system installers to develop startup plans and startup documentation formats, including verification checklists to be completed by installers, during verification check and startup process.
  5. In general, checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with verification checklists being completed before functional testing.
  6. Equipment and system installers execute and document verification checklists and perform verification check and startup. Commissioning Authority documents checklists and startup were completed according to approved plans.
  7. Contractor and equipment and system installers develop specific equipment and system functional performance test procedures to be reviewed by the Commissioning Authority.
  8. Equipment and system installers execute procedures under direction of and documented by Commissioning Authority.
  9. Items of non-compliance in material, installation or setup are corrected at Contractor's expense and system retested.
  10. Commissioning Authority reviews operation and maintenance documentation for completeness.
  11. Commissioning is completed before Substantial Completion.
  12. Commissioning Authority reviews and approves training provided by equipment and system installers and verifies training was completed.
  13. Deferred testing is conducted, as specified.

#### 1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.

## 1.5 COMMISSIONING SUBMITTALS

- A. Furnish one copy of Contract Documents including addenda, change orders, requests for interpretation, and meeting minutes to Commissioning Authority.
- B. Furnish one copy of submittals directly to Commissioning Authority for review and approval at the same time submission is made to the Owner and A/E in accordance with procedures specified in Section 013300 - Submittal Procedures.
  - 1. Make submittals for each piece of equipment or system indicated to be commissioned.
  - 2. Make submittals to Commissioning Authority concurrent with submittals to Architect/Engineer.
  - 3. Distribute one copy of approved submittals to Commissioning Authority.
- C. Furnish one copy of preliminary operation and maintenance data manuals to Commissioning Authority for review and approval at the same time submission is made to the Owner and A/E for each piece of equipment or system indicated to be commissioned.
- D. Make additional submittals requested by Commissioning Authority for each piece of equipment or system indicated to be commissioned. Incorporate requested submittal information into related operation and maintenance manuals. Include the following:
  - 1. Manufacturer's printed detailed installation and start-up, operating, troubleshooting and maintenance procedures.
  - 2. Equipment performance curves.
  - 3. Factory test reports.
  - 4. Full sequence of operation and control diagrams.
  - 5. Proposed testing, adjusting, and balancing procedures.
  - 6. Complete warranty information, with Owner responsibilities to keep warranty in force identified.
  - 7. Lists of installation and checkout materials shipped with equipment.
  - 8. Manufacturer's field checkout forms to be used by factory or field technicians.
  - 9. Other documentation necessary for commissioning process.
- E. Furnish one copy of verification check and startup plan to Commissioning Authority for review and approval. Include the following as minimum:
  - 1. Commissioning Authority's verification checklists with party responsible for each item indicated.
  - 2. Manufacturer's standard startup procedures copied from installation manuals.
  - 3. Manufacturer's standard field checkout sheets.
  - 4. Supplemental procedures and checklists prepared by equipment and system installers to accommodate Project conditions.
  - 5. Sensor and actuator calibration procedures.
  - 6. Include boxes or lines for recording and documenting checking and inspections of each procedure and summary statement with signature block at end of plan.
- F. Submit written training plan to Commissioning Authority for review and approval prior to conducting training including the following:
  - 1. Equipment included in training session.

2. Intended audience.
  3. Location of training.
  4. Objectives.
  5. Subjects covered.
  6. Duration of training on each subject.
  7. Instructor for each subject.
  8. Instructional methods to be used.
- G. Commissioning Authority will review and approve submittals for conformance to Contract Documents as related to commissioning process for primary purpose of aiding development of functional testing procedures and secondarily to verify compliance with equipment specifications.

## 1.6 CLOSEOUT SUBMITTALS

- A. Section 017700 - Execution and Closeout Requirements: Requirements for submittals.
- B. Operation and Maintenance Data: Submit operation and maintenance manuals as specified in individual equipment and system specifications.
1. Submittals made to Commissioning Authority do not constitute compliance with operation and maintenance manual documentation.
- C. Commissioning Record: Commissioning Authority will submit one copy of commissioning record for inclusion in operation and maintenance manuals. Furnish records in following format, arranged by system, with each part separated by tabbed flyleaves:
1. Commissioning Plan.
  2. Final Commissioning Report.
  3. System 1: Provide the following separated by tabbed flyleaves:
    - a. Design narrative and criteria, sequences, approvals.
    - b. Startup plan and report, approvals, corrections, and blank verification checklists. Separate data for each equipment type with colored separators.
    - c. Completed, functional tests, trending and analysis, approvals and corrections, training plan, record and approvals, blank functional test forms, and recommended recommissioning schedule.
  4. System 2: As specified for System 1.
- D. Final Commissioning Report: Commissioning Authority will submit one copy of final commissioning report including the following:
1. Executive summary with list and roles of participants, brief Project description, overview of commissioning and testing scope, and general description of testing and verification methods.
  2. For Each Piece of Commissioned Equipment: Include statement regarding compliance with Contract Documents in the following areas:
    - a. Equipment specifications.
    - b. Equipment installation.
    - c. Functional performance and efficiency.
    - d. Equipment documentation and design intent.
    - e. Operator training.

3. Include recommendations for improvement to equipment or operations, future actions, and commissioning process changes.
4. List outstanding deficiencies referenced to specific functional test, inspection, trend log, or other record where deficiency is documented.
5. Include brief description of verification method used, observations and conclusions from testing for each commissioned piece of equipment and system.

#### 1.7 COMMISSIONING SERVICES

- A. Owner will employ and pay for specified services of an independent firm as Commissioning Authority.

#### 1.8 COMMISSIONING RESPONSIBILITIES

- A. Refer to Section 230813 Mechanical Systems Commissioning, Paragraph 1.6 RESPONSIBILITIES for individual expectations.

#### 1.9 COMMISSIONING MEETINGS

- A. Commissioning Authority will make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings.
- B. Initial Commissioning Meeting:
  1. Commissioning Authority will schedule meeting within 10 days after the start of construction.
  2. Attendance Required: Attendance shall consist of the Commissioning Team as defined in Section 230813, Paragraph 1.4.G.
  3. Agenda:
    - a. Designation of personnel representing parties for commissioning activities.
    - b. Review commissioning process and responsibilities.
    - c. Review commissioning plan development procedures.
    - d. Review required commissioning submittals.
    - e. Present initial commissioning schedule and establish future progress meetings.
- C. Commissioning Authority will record meeting minutes and distribute copies to participants and those affected by decisions made.

#### 1.10 SEQUENCING

- A. Sequence work to complete commissioning, except for functional testing and Owner's personnel training, before Substantial Completion.
- B. Sequence work to achieve Functional Completion before Final Completion. Complete the following for each piece of equipment and system indicated to be commissioned to achieve Functional Completion:
  1. Complete and sign startup and verification checklist documentation.
  2. Submit trend log data.
  3. Submit final approved test and balance report.
  4. Complete functional testing.

5. Complete training of Owner personnel.
  6. Submit approved operation and maintenance data manuals.
  7. Correct identified deficiencies or obtain approval by Owner to exclude deficiencies from Functional Completion.
- C. For equipment or systems where commissioning is delayed by Owner occupancy requirements or other conditions, perform commissioning as specified for seasonal operation equipment.

## 1.11 SCHEDULING

- A. Schedule work to allow adequate time for commissioning activities.
- B. Identify commissioning milestones, activities, and durations on Project schedule.
1. Identify the following for each piece of equipment and system including:
    - a. Operation and maintenance manual submittal.
    - b. Verification check and startup.
    - c. Functional performance test.
    - d. Functional completion.
    - e. Demonstration and training sessions.
    - f. Commissioning completion.

## PART 2 PRODUCTS

### 2.1 TEST EQUIPMENT

- A. Testing Equipment: Calibrated within last year; of sufficient quality and accuracy to test and measure system performance within the following tolerances unless otherwise specified for individual equipment or systems.
1. Temperature Sensors and Digital Thermometers: 0.5 degrees F accuracy and plus or minus 0.1 degrees resolution.
  2. Pressure Sensors: Accuracy of plus or minus 2.0 percent of measured value range.
- B. Recalibrate test equipment according to manufacturer's recommended intervals and when dropped or damaged.
1. Affix calibration tags to test equipment or furnish certificates upon request.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify equipment and systems are installed in accordance with individual specification sections.
- B. Verify utility and power connections are complete and services operational.

### 3.2 VERIFICATION CHECK AND STARTUP PROCEDURES

- A. Notify Commissioning Authority and schedule verification check and startup activities with each party required to complete verification check and startup minimum 2 weeks in advance.
- B. Allow Commissioning Authority to witness verification check and startup for systems identified in Section 230813.
- C. Verification Check and Startup:
  - 1. Perform verification check and startup in accordance with approved verification check and startup plan.
  - 2. Complete entire plan for each piece of equipment or system indicated to be commissioned.
  - 3. Complete each procedure in sequence performed by party assigned to each procedure.
  - 4. Record completion of each procedure. Indicate results of procedure where required. Sign and date plan by individual performing procedure.
  - 5. Identify items not completed successfully.
  - 6. Sign and date plan indicating completion of entire plan.
  - 7. Submit executed plan to Commissioning Authority within 2 days of completion.
- D. Deficiencies and Approvals:
  - 1. Commissioning Authority will review verification check and startup reports and issue deficiency report or approval.
  - 2. Correct deficiencies and resubmit updated verification check and startup report with statement indicating corrections made for Commissioning Authority approval.
  - 3. Repeat process until verification check and startup report is approved.
  - 4. Costs for incomplete verification check and startup items that later cause deficiencies or delays during functional tests may be charged to party responsible for incomplete item.

### 3.3 FUNCTIONAL PERFORMANCE TEST PROCEDURES

- A. Complete the following before performing functional tests:
  - 1. Verification check and startup.
  - 2. Control system testing with approval by Commissioning Authority for use for test and balance operations.
  - 3. Air system balancing and water system balancing.
- B. Notify Commissioning Authority of completion of verification check and startup activities.
- C. Commissioning Authority will witness and document results of functional performance tests.
- D. Conduct functional performance tests as specified in Section 230813.
- E. Demonstrate each piece of equipment and system is operating according to documented design intent and Contract Documents.

1. Conduct testing proceeding from components to subsystems, to systems.
  2. Bring equipment and systems to condition capable full dynamic operation.
  3. Verify performance of individual components and systems.
  4. Verify performance of interactions between systems.
  5. Identify and correct areas of deficient performance.
- F. Operate each piece of equipment and system through each specified mode of operation including seasonal, occupied, unoccupied, warm up, cool down, partial load and full load conditions.
1. Verify each sequence in sequences of operation.
  2. Test for proper responses to power failure, freezing, overheating, low oil pressure, no flow, equipment failure, and other abnormal conditions.

### 3.4 FUNCTIONAL PERFORMANCE TEST METHODS

- A. Perform testing and verification by using manual testing or by monitoring performance and analyzing results using control system trend log capabilities or by stand-alone data loggers as specified for each piece of equipment or system.
1. Commissioning Authority may require alternate or additional method, other than specified method.
  2. Commissioning Authority will determine test method when method is not specified.
- B. Simulated Conditions: Simulating conditions, not by overwritten values, is permitted. Timing tests to use real conditions is encouraged wherever practical.
- C. Overwritten Values: Overwriting sensor values to simulate conditions may be used with caution and avoided when possible.
- D. Simulated Signals: Using signal generator to create simulated signals to test and calibrate transducers automatic temperature controls is generally recommended over using sensors as signal generators with simulated conditions or overwritten values.
- E. Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test specific sequence is acceptable. Reset setpoint after completing test.
- F. Indirect Indicators: Using indirect indicators for responses or performance is permitted only after visually and directly verifying and documenting indirect readings through control system representing actual conditions and responses over tested parameter range.
- G. Perform each function and test under conditions simulating actual conditions as close as is practically possible.
1. Provide materials, system modifications, and other things necessary to produce flows, pressures, temperatures, and other responses to execute test according to specified conditions.
  2. At completion of test, return modified equipment and systems to pretest condition.

- H. Sampling: Multiple identical pieces of equipment or equipment with only small size or capacity differences may be functionally tested using sampling strategy when permitted by the Owner according to following rule.
  - 1. Do not use sampling strategy for equipment with significant differences in application or sequence of operation differences.
  - 2. Where appropriate, the Commissioning Authority shall determine the viability of sample testing, rules, equipment grouping, failure definitions, and rate of sampling.
  - 3. When frequent failures occur, Commissioning Authority may stop testing and require responsible party to perform and document checkout of remaining units, prior to continuing with functional performance testing.

### 3.5 DEFICIENCIES AND TEST APPROVALS

- A. Deficiencies:
  - 1. Commissioning Authority will record and report deficiencies to Owner.
  - 2. Minor deficiencies may be corrected during tests at Commissioning Authority's discretion. Deficiency and resolution will be documented on procedure form.
  - 3. Failure to attend scheduled verification check, startup, or functional performance test will be considered deficiency.
  - 4. When deficiency is identified, coordinate with the Commissioning Authority for resolution.
- B. Provide written report to Commissioning Authority before each scheduled commissioning meeting concerning status of each deficiency. Include explanations of disagreements with resolution proposals for each discrepancy.
  - 1. Commissioning Authority will retain original deficiency forms until end of Project.
- C. Test Approval: Commissioning Authority notes each satisfactorily demonstrated function on functional performance test form.
  - 1. Commissioning Authority recommends acceptance of each test to Owner using standard form.
  - 2. Owner gives final approval for each test using same form, providing signed copy to Commissioning Authority and Contractor.

### 3.6 DEMONSTRATION & TRAINING

- A. Demonstrate equipment and systems and train Owner's personnel as specified in individual equipment and system specifications.

END OF SECTION

SECTION 024119  
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 015000 "Temporary Facilities and Controls" for temporary facilities and control requirements.
3. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
4. Section 017300 "Execution" for cutting and patching procedures.
5. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.2 DEFINITIONS

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

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

#### 1.4 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site .
  1. Inspect and discuss condition of construction to be selectively demolished.
  2. Review structural load limitations of existing structure.
  3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
  5. Review areas where existing construction is to remain and requires protection.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property , for environmental protection , for dust control and , for noise control. Indicate proposed locations and construction of barriers.
- C. Schedule of Selective Demolition Activities: Indicate the following:
  1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's on-site operations are uninterrupted.
  2. Interruption of utility services. Indicate how long utility services will be interrupted.
  3. Coordination for shutoff, capping, and continuation of utility services.
  4. Use of elevator and stairs.
  5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- D. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.
- E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- F. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

## 1.6 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

## 1.7 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

## 1.8 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
  - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
  - 2. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.

## 1.9 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

## 1.10 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

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

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.
  - 1. Inventory and record the condition of items to be removed and salvaged.
  - 2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

### 3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

### 3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off utilities with utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
  - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
  - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
  - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
  - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

### 3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  4. Cover and protect furniture, furnishings, and equipment that have not been removed.
  5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
  1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

### 3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  2. 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. Temporarily cover openings to remain.
  3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  4. 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 portable fire-suppression devices during flame-cutting operations.
  5. Maintain fire watch during and for at least 1 hours after flame-cutting operations.
  6. Maintain adequate ventilation when using cutting torches.
  7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  10. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
1. Clean salvaged items.
  2. Store items in a secure area until delivery to Owner.
  3. Transport items to Owner's storage area designated by Owner.
  4. 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.
  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: Protect construction indicated to remain against damage and soiling during selective demolition. 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.

### 3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.
- E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing so that building interior remains watertight and weathertight. See Section for new roofing requirements.
  - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
  - 2. Remove existing roofing system down to substrate.

### 3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."
  - 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.
  - 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

### 3.8 CLEANING

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

END OF SECTION

SECTION 033000  
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete standards.
2. Concrete materials.
3. Admixtures.
4. Fiber reinforcement.
5. Vapor retarders.
6. Floor and slab treatments.
7. Liquid floor treatments.
8. Curing materials.
9. Accessories.
10. Repair materials.
11. Concrete mixture materials.
12. Concrete mixture class types.
13. Concrete mixing.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement or blended hydraulic cement alone or in combination with one or more of the following:

1. Fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cementitious Materials (w/cm) Ratio: The ratio by weight of mixing water to cementitious materials.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Portland cement.
2. Blended hydraulic cement.
3. Performance-based hydraulic cement.
4. Fly ash.
5. Slag cement.
6. Silica fume.
7. Natural or other pozzolans.
8. Aggregates.
9. Admixtures:

- a. Include limitations of use. Admixtures that do not comply with reference ASTM International requirements must be submitted with test data for approval.
  - 10. Fiber reinforcement.
  - 11. Vapor retarders.
  - 12. Floor and slab treatments.
  - 13. Liquid floor treatments.
  - 14. Curing materials.
  - 15. Joint fillers.
  - 16. Repair materials.
- B. Design Mixtures: For each concrete mixture, include the following:
- 1. Mixture identification.
  - 2. Compressive strength at 28 days or other age as specified.
  - 3. Compressive strength required at stages of construction.
  - 4. Durability exposure classes for Exposure Categories F, S, W, and C.
  - 5. Maximum w/cm ratio.
  - 6. Calculated equilibrium and fresh density for lightweight concrete.
  - 7. Slump or slump flow limit.
  - 8. Air content.
  - 9. Nominal maximum aggregate size.
  - 10. Steel-fiber reinforcement content.
  - 11. Synthetic microfiber content.
  - 12. Synthetic macrofiber content.
  - 13. Intended placement method.
  - 14. Submit adjustments to design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant changes.
- C. Concrete Schedule: For each location of each class of concrete indicated in "Concrete Mixture Class Types" Article, including the following:
- 1. Concrete class designation.
  - 2. Location within Project.
  - 3. Exposure class designation.
  - 4. Formed surface finish designation and final finish.
  - 5. Final finish for floors.
  - 6. Floor treatment, if any.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For the following:
- 1. Installer: Include copies of applicable ACI certificates.
- B. Material Certificates: For each of the following:
- 1. Cementitious materials.
  - 2. Admixtures.

3. Fiber reinforcement.
4. Curing compounds.
5. Floor and slab treatments.
6. Bonding agents.
7. Adhesives.
8. Vapor retarders.
9. Semirigid joint filler.
10. Joint-filler strips.
11. Repair materials.

C. Material Test Reports: For the following:

1. Portland cement.
2. Blended hydraulic cement.
3. Performance-based hydraulic cement.
4. Fly ash.
5. Slag cement.
6. Silica fume.
7. Natural or other pozzolans.
8. Aggregates.
9. Ground calcium carbonate and aggregate mineral filler.
10. Admixtures.

D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances in accordance with ACI 117 and in compliance with ASTM E1155.

E. Research Reports:

1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder/termite barrier, showing compliance with ICC's Acceptance Criteria AC380.

F. Preconstruction Test Reports: For each mix design.

G. Field quality-control reports.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified Installer who employs Project personnel qualified as an ACI-certified Concrete Flatwork Associate and Concrete Flatwork Finisher and a supervisor who is a certified ACI Advanced Concrete Flatwork Finisher/Technician or an ACI Concrete Flatwork Finisher with experience installing and finishing concrete.

1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer's production facilities and delivery vehicles certified in accordance with NRMCA's certification requirements or equivalent approval by a State DOT.
- C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing that performs duties on behalf of the Architect/Engineer.

## 1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
  1. Include the following information in each test report:
    - a. Admixture dosage rates.
    - b. Slump.
    - c. Air content.
    - d. Seven-day compressive strength.
    - e. 28-day compressive strength.
    - f. Evaluation of permeability-reducing admixtures.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM C94/C94M and ACI 301.

## 1.8 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 301 as follows:
  1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  2. When air temperature has fallen to, or is expected to fall below 40 deg F during the protection period, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  3. Do not use frozen materials or materials containing ice or snow.
  4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
- B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
  1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
  2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

## 1.9 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite

barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 CONCRETE STANDARDS

- A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

### 2.2 CONCRETE MATERIALS

- A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type of admixture from single source from single manufacturer.

- B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M,
2. Blended Hydraulic Cement: ASTM C595/C595M, Type IS, portland blast-furnace slag cement.
3. Pozzolans: ASTM C618, Class C, F, or N.
4. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
5. Ground Glass Pozzolan: ASTM C1866/C1866M, Type GS or GE.
6. Silica Fume: ASTM C1240.

- C. Normal-Weight Aggregates:

1. Coarse Aggregate: ASTM C33/C33M, Class 3M
2. Maximum Coarse-Aggregate Size: 1 inch nominal.
3. Fine Aggregate: ASTM C33/C33M.
4. Recycled Aggregate: Provide documentation of characteristics of recycled aggregate and mechanical properties and durability of proposed concrete, which incorporates recycled aggregate to conform to applicable requirements for the class of concrete.
5. Alkali-Silica Reaction: Comply with one of the following for each aggregate used:
  - a. Expansion Result of Aggregate: Not more than 0.04 percent at one year when tested in accordance with ASTM C1293.
  - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567. Do not use this option with fly ash with an alkali content greater than 4.0 percent. Submit supporting data for each

aggregate showing expansion in excess of 0.10 percent when tested in accordance with ASTM C1260.

- c. Alkali Content in Concrete: Not to exceed 4 lb./cu. yd. for aggregate with expansion greater than or equal to 0.04 percent and less than 0.12 percent or 3 lb./cu. yd. for aggregate with expansion greater than or equal to 0.12 percent and less than 0.24 percent. Test aggregate reactivity in accordance with ASTM C1293. Calculate alkali content of concrete in accordance with ACI 301. Do not use this option with natural pozzolan or fly ash that has a calcium oxide content greater than 18 percent or an alkali content greater than 4.0 percent; or for an aggregate with expansion at one year greater than or equal to 0.24 percent when tested in accordance with ASTM C1293.

## 2.3 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C260/C260M.
- B. Chemical Admixtures: Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
  - 2. Retarding Admixture: ASTM C494/C494M, Type B.
  - 3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
  - 5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
  - 6. Admixtures with special properties, with documentation of claimed performance enhancement, ASTM C494/C494M, Type S.
  - 7. Moisture-Vapor-Reducing Admixture: ASTM C494/C494M, Type S, hydrophilic, moisture-vapor-reducing, capable of reducing water absorption in and moisture-vapor emission from concrete (MVRA).
- C. Mixing Water for Concrete Mixtures and Water Used to Make Ice: ASTM C1602/C1602M. Include documentation of compliance with limits for alkalis, sulfates, chlorides, or solids content of mixing water from Table 2 in ASTM C1602/C1602M.

## 2.4 FIBER REINFORCEMENT

- A. Carbon-Steel-Wire Fiber: ASTM A820/A820M, Type 1, cold-drawn wire, deformed, minimum of 1.5 inches long, with an aspect ratio of 35 to 40.
- B. Carbon-Steel Cut Sheet Fiber: ASTM A820/A820M, Type 2, cut sheet, deformed, minimum of 1.5 inches long, and aspect ratio of 35 to 40.
- C. Synthetic Monofilament Microfiber: Monofilament polypropylene microfibers complying with ASTM C1116/C1116M, Type III, 1/2 to 1-1/2 inches long.

- D. Synthetic Fibrillated Microfiber: Fibrillated polypropylene microfibers complying with ASTM C1116/C1116M, Type III, 1/2 to 1-1/2 inches long.
- E. Synthetic Macrofiber: Synthetic macrofibers complying with ASTM C1116/C1116M, Type III, 1 to 2-1/4 inches long.

## 2.5 VAPOR RETARDERS

- A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A. Include manufacturer's recommended thickness and adhesive or pressure-sensitive tape.
- B. Sheet Vapor Retarder, Class C: ASTM E1745, Class C; not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

## 2.6 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
  - 1. Color:
    - a. Ambient Temperature Below 50 deg F (10 deg C): Black.
    - b. Ambient Temperature between 50 and 85 deg F (10 and 29 deg C): Any color.
    - c. Ambient Temperature Above 85 deg F (29 deg C): White.
- D. Water: Potable water that does not cause staining of the surface.

## 2.7 ACCESSORIES

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, in accordance with ASTM D2240.
- C. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Floor Slab Protective Covering: 8 ft. wide cellulose fabric.

## 2.8 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
  2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as recommended by underlayment manufacturer.
  4. Compressive Strength: Not less than 4100 psi at 28 days when tested in accordance with ASTM C109/C109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
  2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
  3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
  4. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C109/C109M.

## 2.9 CONCRETE MIXTURE MATERIALS

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland or hydraulic cement in concrete assigned to Exposure Class F3 as follows:
1. Fly Ash or Other Pozzolans: 25 percent by mass.
  2. Slag Cement: 50 percent by mass.
  3. Silica Fume: 10 percent by mass.

4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
  5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
1. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
  2. Use permeability-reducing admixture in concrete mixtures where indicated.
- D. Color Pigment: Add color pigment to concrete mixture in accordance with manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

## 2.10 CONCRETE MIXTURE CLASS TYPES

- A. Class C: Normal-weight concrete used for interior slabs-on-ground and suspended slabs.
1. Exposure Class: ACI 318 F0 S0 W0 C0.
  2. Minimum Compressive Strength: 3000 psi at 28 days.
  3. Slump Limit: Contractor to select target slump based on ASTM C143/C143M.
  4. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.
  5. Air Content:
    - a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
  6. Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 4.0 lb/cu. yd.

## 2.11 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and furnish delivery ticket.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
  2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..

3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

#### A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

#### A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

### 3.3 TOLERANCES

#### A. Comply with ACI 117.

### 3.4 INSTALLATION OF EMBEDDED ITEMS

#### A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install reglets to receive waterproofing and through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

### 3.5 INSTALLATION OF VAPOR RETARDERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
  - 1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
  - 2. Face laps away from exposed direction of concrete pour.
  - 3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
  - 4. Lap joints 6 inches and seal with manufacturer's recommended tape.
  - 5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
  - 6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
  - 7. Protect vapor retarder during placement of reinforcement and concrete.
    - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides and sealing to vapor retarder.

### 3.6 INSTALLATION OF CAST-IN-PLACE CONCRETE

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
  - 1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
  - 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Water addition in transit or at the Project site must be in accordance with ASTM C94/C94M and must not exceed the permitted amount indicated on the concrete delivery ticket.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
  - 1. If a section cannot be placed continuously, provide construction joints as indicated.
  - 2. Deposit concrete to avoid segregation.
  - 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
  - 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

- a. Do not use vibrators to transport concrete inside forms.
  - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
  - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
  - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  - 1. Do not place concrete floors and slabs in a checkerboard sequence.
  - 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 3. Maintain reinforcement in position on chairs during concrete placement.
  - 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
  - 5. Level concrete, cut high areas, and fill low areas.
  - 6. Slope surfaces uniformly to drains where required.
  - 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
  - 8. Do not further disturb slab surfaces before starting finishing operations.

### 3.7 INSTALLATION OF JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
  - 1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
  - 2. Place joints perpendicular to main reinforcement.
    - a. Continue reinforcement across construction joints unless otherwise indicated.
  - 3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
  - 4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  - 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  - 6. Space vertical joints in walls as indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
  - 7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  - 8. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
  2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 07 92 00 "Joint Sealants," are indicated.
  3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints:
1. Install dowel bars and support assemblies at joints where indicated on Drawings.
  2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.
- F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

### 3.8 APPLICATION OF FINISHING FLOORS AND SLABS

- A. Trowel Finish:
1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
  2. Continue troweling passes and restraighen until surface is free of trowel marks and uniform in texture and appearance.
  3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  4. Do not add water to concrete surface. Use of an approved finishing aid is acceptable.
  5. Do not apply troweled finish to concrete, which has a total air content greater than 3 percent.
  6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:
  - a. Slabs on Ground:
    - 1) Unless otherwise specified
      - a) Specified overall values of flatness,  $F_F$  35; and of levelness,  $F_L$  25; with minimum local values of flatness,  $F_F$  24; and of levelness,  $F_L$  17.
    - 2) For Gymnasium and Weight Room Floors
      - a) Specified overall values of flatness,  $F_F$  45; and of levelness,  $F_L$  35; with minimum local values of flatness,  $F_F$  30; and of levelness,  $F_L$  24.
    - 3) For areas to be polished
      - a) Specified overall values of flatness,  $F_F$  50; and of levelness,  $F_L$  35; with minimum local values of flatness,  $F_F$  40; and of levelness,  $F_L$  24.

### 3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

#### A. Filling in:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to match color and texture with in-place construction exposed to view.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

### 3.10 APPLICATION OF CONCRETE CURING

#### A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305R, before and during finishing operations.

#### B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for remainder of curing period as follows:

- a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
- b. Continuous Sprinkling: Maintain concrete surface continuously wet.
- c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
- d. Water-Retention Sheetting Materials: Cover exposed concrete surfaces with sheetting material, taping, or lapping seams.
- e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
  - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
  - 2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

- 1. Begin curing after finishing concrete.
- 2. Interior Concrete Floors:
  - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
    - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
      - a) Lap edges and ends of absorptive cover not less than 12 inches.
      - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
    - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
      - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
      - b) Cure for not less than seven days.
    - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following not in cold weather:
      - a) Water.
      - b) Continuous water-fog spray.
  - b. Floors To Receive Curing Compound:

- 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
- 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
- 3) Maintain continuity of coating, and repair damage during curing period.
- 4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

c. Floors To Receive Curing and Sealing Compound:

- 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
- 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
- 3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

### 3.11 INSTALLATION OF JOINT FILLING

- A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
  1. Defer joint filling until concrete has aged at least one month(s).
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.
- D. Overfill joint, and trim joint filler flush with top of joint after hardening.

### 3.12 INSTALLATION OF CONCRETE SURFACE REPAIRS

- A. Defective Concrete:
  1. Repair and patch defective areas when approved by Architect.
  2. Remove and replace concrete that cannot be repaired and patched to meet specification requirements.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks in excess of 0.01 inch spalls, air bubbles exceeding surface finish limits,

honeycombs, rock pockets, fins and other projections on the surface exceeding surface finish limits, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.
  - a. Limit cut depth to 3/4 inch.
  - b. Make edges of cuts perpendicular to concrete surface.
  - c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
  - d. Fill and compact with patching mortar before bonding agent has dried.
  - e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
  - a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
  - b. Compact mortar in place and match surrounding surface.
3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance, as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
  - a. Correct low and high areas.
  - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by adding patching mortar.
  - a. Finish repaired areas to blend into adjacent concrete.
5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
  - a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  - b. Feather edges to match adjacent floor elevations.

6. Correct other low areas scheduled to remain exposed with repair topping.
  - a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
  - b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.
  - a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
  - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
  - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
  - d. Place, compact, and finish to blend with adjacent finished concrete.
  - e. Cure in same manner as adjacent concrete.
8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.
  - a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
  - b. Dampen cleaned concrete surfaces and apply bonding agent.
  - c. Place patching mortar before bonding agent has dried.
  - d. Compact patching mortar and finish to match adjacent concrete.
  - e. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

### 3.13 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Delivery Tickets: comply with ASTM C94/C94M.
- C. Inspections:
  1. Headed bolts and studs.
  2. Verification of use of required design mixture.
  3. Concrete placement, including conveying and depositing.
  4. Curing procedures and maintenance of curing temperature.

5. Verification of concrete strength before removal of shores and forms from beams and slabs.
  6. Batch Plant Inspections: On a random basis, as determined by Architect.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 150 cu. yd. or fraction thereof.
    - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing is to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  2. Slump: ASTM C143/C143M:
    - a. One test at point of delivery for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    - b. Perform additional tests as needed.
  3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;.
    - a. One test for each composite sample when strength test specimens are cast, but not less than one test for each day's pour of each concrete mixture.
  4. Concrete Temperature: ASTM C1064/C1064M:
    - a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample when strength test specimens are cast.
  5. Compression Test Specimens: ASTM C31/C31M:
    - a. Cast and standard cure two sets of three 6 inches by 12-inches or 4-inch by 8-inch cylindrical specimens for each composite sample.
  6. Compressive-Strength Tests: ASTM C39/C39M.
    - a. Test one standard cured specimens at seven days and one set of three specimens at 28 days.
    - b. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
  7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests of standard cured cylinders equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less

than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.

8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
  9. Additional Tests:
    - a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
    - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
      - 1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.7.6.3.
  10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
  11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- E. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 24 hours of completion of floor finishing and promptly report test results to Architect.

### 3.14 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using floor slab protective covering.

END OF SECTION

SECTION 061000  
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Wood blocking
  - 2. Wood furring and grounds.
  - 3. Wood sleepers.
  - 4. Plywood backing panels.

1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
  - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
  - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
  - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## PART 2 - PRODUCTS

### 2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
  - 3. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber:
  - 1. Dimension Lumber: 15 percent for 2-inch nominal thickness or less; 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

### 2.2 PRESERVATIVE TREATMENT

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
  - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
  - 2. For exposed items indicated to receive a stained or natural finish, chemical formulations are not to require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
  - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

- D. Application: Treat items indicated on Drawings, and the following:
1. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
  2. Wood floor plates that are installed over concrete slabs-on-grade.

#### FIRE-RETARDANT TREATMENT

- E. General: Where fire-retardant-treated materials are indicated, materials are to comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- F. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
1. Treatment is not to promote corrosion of metal fasteners.
  2. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
  3. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
  4. Design Value Adjustment Factors: Treated lumber is to be tested according to ASTM D5664 and design value adjustment factors are to be calculated according to ASTM D6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.
- G. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.
- H. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by testing agency.
- I. For exposed items indicated to receive a stained or natural finish, chemical formulations are not to bleed through, contain colorants, or otherwise adversely affect finishes.
- J. Application: Treat all rough carpentry unless otherwise indicated. items indicated on Drawings, and the following:

## 2.3 MISCELLANEOUS LUMBER

- A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.
  - 3. Furring.
  - 4. Grounds.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:
  - 1. Hem-fir (north); NLGA.
  - 2. Mixed southern pine or southern pine; SPIB.
  - 3. Spruce-pine-fir; NLGA.
  - 4. Hem-fir; WCLIB or WWPA.
  - 5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
  - 6. Northern species; NLGA.
- C. Concealed Boards: 15 19 percent maximum moisture content and any of the following species and grades:
  - 1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
  - 2. Hem-fir or hem-fir (north); Standard or No. 3 Common grade; NLGA, WCLIB, or WWPA.
  - 3. Eastern softwoods; No. 3 Common grade; NeLMA.
  - 4. Northern species; No. 3 Common grade; NLGA.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

## 2.4 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

## 2.5 FASTENERS

- A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
  - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened
- E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC193 as appropriate for the substrate.
  - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
  - 2. Where required for compatibility with wood treatment:
    - a. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2

## 2.6 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cleveland Steel Specialty Co.
  - 2. KC Metals Products, Inc.
  - 3. Phoenix Metal Products, Inc.
  - 4. Simpson Strong-Tie Co., Inc.
- B. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
  - 1. Use for wood-preservative-treated lumber and where indicated.
- C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304 .
  - 1. Use for exterior locations and where indicated.

## 2.7 MISCELLANEOUS MATERIALS

### A. Sill-Sealer Gaskets:

1. Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.

### B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

### C. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

#### A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

#### B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

#### C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

#### D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

#### E. Do not splice structural members between supports unless otherwise indicated.

#### F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

#### G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.

2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
  3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
  4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
1. Use inorganic boron for items that are continuously protected from liquid water.
  2. Use copper naphthenate for items not continuously protected from liquid water.
- J. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- K. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
  2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
  3. ICC-ES evaluation report for fastener.
- L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

### 3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of

ground to exact thickness of finish material. Remove temporary grounds when no longer required.

### 3.3 INSTALLATION OF WOOD FURRING

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- size furring horizontally and vertically at 24 inches o.c.
- C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- size furring vertically at 16 inches o.c.

### 3.4 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 064116  
PLASTIC-LAMINATE-CLAD ARCH CABINETS, COUNTERTOPS, & WALL PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad architectural cabinets.
2. Cabinet hardware and accessories.
3. Miscellaneous materials.
4. Plastic-laminate-clad countertops.
5. Plastic-laminate-faced wood paneling.
6. Accessories.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.

1.2 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Plastic-laminate-clad architectural cabinets.
2. Cabinet hardware and accessories.
3. Miscellaneous materials.
4. Plastic-laminate-clad countertops.
5. Plastic-laminate-faced wood paneling.
6. Accessories.

B. Product Data Submittals: For each product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

C. Shop Drawings:

1. Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.

2. Show large-scale details.
  3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
  4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets and plastic-laminate-clad countertops.
  5. Apply AWI Quality Certification Program label to Shop Drawings.
- D. Samples: For each exposed product and for each color and texture specified, in manufacturer's or manufacturer's standard size. Plastic laminates in each type, color, pattern, and surface finish required in manufacturer's standard size.
- E. Samples for Verification: As follows:
1. Plastic Laminates: For each type, color, pattern, and surface finish required, 8 by 10 inches in size.
  2. Wood-Grain Plastic Laminates: For each type, color, pattern, and surface finish required, 12 by 24 inches in size.
  3. Fabrication Sample: For each type and profile of countertop required, provide one sample applied to core material with specified edge material applied to one edge.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator and Installer.
- B. Product Certificates: For each type of product.
1. Composite wood products.
  2. Thermally fused laminate panels.
  3. High-pressure decorative laminate.
  4. Glass.
  5. Adhesives.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program .
- B. Installer Qualifications: Licensed participant in AWI's Quality Certification Program .

- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Build mockups of typical paneling as indicated on Drawings.
  - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
- B. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.
- C. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
- D. Keep surfaces of countertops covered with protective covering during handling and installation.
- E. Do not deliver paneling until painting and similar operations that might damage paneling have been completed in installation areas. Store paneling in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

#### 1.8 FIELD CONDITIONS

- A. Environmental Limitations with Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.
- B. Field Measurements: Where cabinets or countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

## PART 2 - PRODUCTS

### 2.1 PLASTIC-LAMINATE-FACED WOOD PANELING

- A. Grade: Premium.
- B. Plastic Laminate: High-pressure decorative laminate complying with ISO 4586-3.
  - 1. Faces: Grade HGS.
  - 2. Backs: Balance material with thickness matching exposed surface.
  - 3. Exposed Edges: Same as faces.
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed surfaces complying with the following requirements:
  - 1. As indicated on drawings Finish Schedule for basis of design.
- D. Panel Core: MDF.
  - 1. Thickness: 3/4 inch.
- E. Testing requirements: Laminated products factory produced with a wood substrate shall comply with one of the following:
  - 1. The laminated product shall meet the criteria of Section 803.1.1.1 when tested in accordance with NFPA 286 using the product-mounting system, including adhesive, as described in Section 5.8 of NFPA 286.
    - a. During the 40 kW exposure, flames shall not spread to the ceiling.
    - b. The flame shall not spread to the outer extremity of the sample on any wall or ceiling.
    - c. Flashover, as defined in NFPA 286, shall not occur.
    - d. The peak heat release rate throughout the test shall not exceed 800 kW.
    - e. The total smoke released throughout the test shall not exceed 1,000m<sup>2</sup>.
  - 2. The laminated product shall have a Class A, B, or C [flame spread index](#) and [smoke-developed index](#), based on the requirements of [Table 803.13](#), in accordance with ASTM E84 or UL 723. Test specimen preparation and mounting shall be in accordance with ASTM E2579.
- F. Exposed Panel Edges: Plastic-laminate matching faces.
- G. Panel Reveals: See casework and panel elevations for panel reveal profiles and basis of design.
- H. Adhesives for Bonding Plastic Laminate: Type I, waterproof type as selected by fabricator to comply with requirements.
  - 1. Adhesive for Bonding Edges: Hot-melt adhesive.
- I. Assemble panels by gluing and concealed fastening.

## 2.2 ARCHITECTURAL CABINETS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Rockwood Specialties, Basset, Va Phone: (276) 627-8010
  - 2. Legacy Cabinets & Millwork, Harrisonburg, Va Phone: (540) 437-1897

## 2.3 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
  - 1. Provide certificates from AWI certification program indicating that woodwork and installation complies with requirements of grades specified.
- B. Architectural Woodwork Standards Grade: Custom.
- C. Type of Construction: Frameless .
- D. Door and Drawer-Front Style: Flush overlay.
- E. High-Pressure Decorative Laminate: ISO 4586-3, grades as indicated or if not indicated, as required by quality standard.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Nevamar Company, LLC. (Basis of Design)
    - b. Formica Corporation.
    - c. Pionite; a Panolam Industries International, Inc. brand.
    - d. Wilsonart LLC.
- F. Exposed Surfaces:
  - 1. Plastic-Laminate Grade: VGS .
  - 2. Edges: PVC edge banding. 3.0 mm thick, matching laminate in color, pattern, and finish.
  - 3. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.
- G. Semiexposed Surfaces:
  - 1. Surfaces Other Than Drawer Bodies: Thermally fused laminate panels.
    - a. Edges of Plastic-Laminate Shelves: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
    - b. Edges of Thermally Fused Laminate Panel Shelves: PVC or polyester edge banding.

- c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, ISO 4586-3, grade to match exposed surface.
- 2. Drawer Sides and Backs: Solid-hardwood lumber
- 3. Drawer Bottoms: hardwood plywood.
- H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, ISO 4583-3, grade to match exposed surface.
- I. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
  - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. As selected by Architect from laminate manufacturer's full range in the following categories:
    - a. Solid colors, gloss finish.
    - b. Solid colors, matte finish.
    - c. Wood grains, matte finish.

## 2.4 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
  - 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
  - 1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
  - 2. Softwood Plywood: DOC PS 1.

## 2.5 CABINET HARDWARE AND ACCESSORIES

- A. Cabinet Hardware: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 08 71 00 "Door Hardware."
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Grass America.
    - b. Hettich America L.P.

- c. Knappe & Vogt Manufacturing Company.
- B. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 100 degrees of opening.
- C. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.
  - 1. Basis of Design: Stanley, Ives. Satin anodized aluminum; 5/16Ø, "U" pull 1-5/16" proj. x 3-1/2" centers.
- D. Shelf Rests: ANSI/BHMA A156.9, B04013; plastic .
- E. Drawer Slides: ANSI/BHMA A156.9.
  - 1. Standard Duty (Grade 1 and Grade 2): Side mount .
  - 2. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200): Undermount.
    - a. Type: Full extension.
    - b. Material: Galvanized steel ball bearing Stainless steel slides.
    - c. Motion Feature: Self-closing mechanism.
  - 3. Pencil drawers not more than 3 inches high and not more than 24 inches wide, provide 50 lb load capacity.
  - 4. General-purpose drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide 75 lb load capacity.
  - 5. File drawers more than 6 inches high or more than 24 inches wide, provide 100 lb load capacity.
  - 6. Lateral file drawers more than 6 inches high and more than 24 inches but not more than 30 inches wide, provide 150 lb load capacity.
  - 7. Lateral file drawers more than 6 inches high and more than 30 inches wide, provide 200 lb load capacity.
  - 8. Computer keyboard tray, provide 75 lb load capacity.
- F. Door Locks: ANSI/BHMA A156.11, E07121.
- G. Drawer Locks: ANSI/BHMA A156.11, E07041.
- H. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.
- I. Tempered Float Glass for Cabinet Doors: ASTM C1048, Kind FT, Condition A, Type I, Class 1 (clear) , Quality-Q3, 6 mm thick unless otherwise indicated.
- J. Tempered Float Glass for Cabinet Shelves: ASTM C1048, Kind FT, Condition A, Type I, Class 1 (clear) , Quality-Q3; with exposed edges seamed before tempering, 6 mm thick.
- K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
  - 1. Satin Stainless Steel: ANSI/BHMA 630.
- L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

- M. Grommets for cable passage: HAFELE Catalog #429.93.322
- N. Under Desk Hanging Cable Tray: Mockett WM4
- O. Cork Tack Surface **[TB-1] & [TB-2]**
1. Location & Size: As indicated on drawings.
  2. Material: Homogeneous tackable surface material made of primary natural materials consisting of linseed oil, cork, rosin binders and dry pigments mixed and calendared onto a natural jute backing. The uni-color extends throughout the thickness of the material.
    - a. Basis of Design: Forbo Bulletin Board tackable surface sheet material
  3. Thickness: 1/4" thick
  4. Color: To be selected from manufacturer's full range by Architect.
  5. Adhesive: Manufactures standard adhesives.
- P. Acrylic Workstation Divider: **[DP-1]**
1. Location: As indicated on drawings.
  2. Divider size(s):
    - a. 42"W x 16.5"H
    - b. 20"W x 16.5"H
  3. Countertop Attachment: Countertop Direct Mount Bracket. Basis of Design: Mockett PGRP3/F-94 Privacy Screen Panel Bracket
  4. Material: 1/2" thick Acrylic
  5. Finish: Frosted
- Q. Felt Workstation Divider: **[DP-2]**
1. Location: As indicated on drawings.
  2. Divider size(s): 42"W x 16.5"H
  3. Countertop Attachment: Countertop Direct Mount Bracket. Basis of Design: Mockett PGRP3/F-94 Privacy Screen Panel Bracket
  4. Material: PET Felt, 12mm Thick
  5. Color: To be selected from manufacturer's full range by Architect.

## 2.6 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber , kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesive for Bonding Plastic Laminate: Type I, waterproof type as selected by fabricator to comply with requirements.
  - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

## 2.7 PLASTIC-LAMINATE-CLAD COUNTERTOPS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.
  - 1. Provide inspections of fabrication and installation together with labels and certificates from AWI certification program indicating that countertops comply with requirements of grades specified.
  - 2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.
- B. Grade: Custom.
- C. High-Pressure Decorative Laminate: ISO 4586-3, Grade HGS.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Nevamar Company, LLC. (Basis of Design)
    - b. Formica Corporation.
    - c. Pionite; a Panolam Industries International, Inc. brand.
    - d. Wilsonart LLC.
- D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. As selected by Architect from manufacturer's full range in the following categories:
    - a. Solid colors, matte finish.
    - b. Solid colors with core same color as surface, matte finish.
- E. Edge Treatment: 3.0-mm PVC edging.

- F. Core Material: MDF or Plywood.
- G. Core Material at Sinks: Type II veneer core hardwood plywood or phenolic resin 45 psf density particle-board with 2/4" thickness built up to 1-1/4" with backer ply for "non-drip: edge profile.
- H. Core Thickness: 3/4 inch.
  - 1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.

## 2.8 FABRICATION

- A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - 1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
  - 2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, plumbing fixtures, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
  - 1. Seal edges of cutouts by saturating with varnish.
- D. Install glass to comply with applicable requirements in Section 08 80 00 "Glazing" and in GANA's "Glazing Manual."
  - 1. For glass in frames, secure glass with removable stops.
  - 2. For exposed glass edges, polish and grind smooth.
- E. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:
  - 1. Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.
- B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing.

### 3.2 INSTALLATION

- A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.
- B. Assemble cabinets and countertops and complete fabrication at Project site to extent that it was not completed in the shop.
  - 1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
  - 2. Seal edges of cutouts by saturating with varnish.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.
  - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
  - 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.
- E. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
  - 1. Secure field joints in countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten in accordance with manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

- F. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- G. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
  - 1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8-inch-in-96-inches variation from a straight, level plane.
  - 2. Secure backsplashes to walls with adhesive.
  - 3. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.
- H. Install paneling level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches. Install with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.
  - 1. For flush paneling with revealed joints, install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/16 inch.
- I. Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening unless covered by trim.

### 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.
- D. Repair damaged and defective paneling, where possible, to eliminate defects. Where not possible to repair, replace paneling. Adjust for uniform appearance.
- E. Clean paneling on exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 072100  
THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Sound attenuation insulation.

1.3 DEFINITIONS

- A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 1. Surface-Burning Characteristics: ASTM E 84.
  - 2. Fire-Resistance Ratings: ASTM E 119.
  - 3. Combustion Characteristics: ASTM E 136.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with

manufacturer's written instructions for handling, storing, and protecting during installation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 GLASS-FIBER BLANKET INSULATION

- A. Manufacturers:
  - 1. CertainTeed Corporation.
  - 2. Guardian Fiberglass, Inc.
  - 3. Johns Manville.
  - 4. Knauf Fiber Glass.
  - 5. Owens Corning.
- B. Sound Attenuation Batts
- C. Type: Unfaced glass fiber acoustical insulation complying with
- D. ASTM C 665, Type I.
- E. Surface Burning Characteristics:
  - 1. Maximum flame spread: 10
  - 2. Maximum smoke developed: 10When tested in accordance with ASTM E 84.
- F. Combustion Characteristics:
  - 1. Passes ASTM E 136.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

### 3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

### 3.4 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:
  - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
  - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. For metal-framed wall cavities where cavity heights exceed 96 inches , support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

### 3.5 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 078413  
PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Penetration firestopping systems.
- B. Related Requirements:
  - 1. Section 078443 "Joint Firestopping" for joints in or between fire-resistance-rated construction.

1.2 REFERENCES

- A. The following publications govern the work of this Section and are hereby incorporated in the Contract Documents as if bound herein. The standards described apply generally unless specifically indicated otherwise in the text. They are identified below by their publishers and are referred to in the text by basic designation only.
  - 1. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)ASTM E 84B91a Surface Burning Characteristics of Building MaterialsASTM E 814B88 Fire Tests of Through-Penetration Fire StopsASTM C 1193B91 Guide for Use of Joint Sealants
  - 2. UNDERWRITERS LABORATORIES (UL)UL-05B92 Fire Resistance DirectoryUL 723B93 Test for Surface Burning Characteristics of Building MaterialsUL 1479B83 Fire Tests of Through-Penetration FirestopsUL 2079 Tests for Fire Resistance of Building Joint Systems

1.3 ACTION SUBMITTALS

- A. Product Data: Penetration firestopping systems.
- B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Listed System Designs: For each penetration firestopping system, for tests performed by a qualified testing agency.

## 1.5 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Approvals according to FM Approvals 4991, "Approval Standard for Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

## 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

## 1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

## PART 2 - PRODUCTS

### 2.1 SOURCE LIMITATIONS

- A. Obtain penetration firestop systems for each type of opening indicated from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
  - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.

2. Test in accordance with testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
  - a. Penetration firestop systems installed with products bearing the classification marking of a qualified product certification agency in accordance with listed system designs published by a qualified testing agency.
    - 1) UL in its online directory "Product iQ."
    - 2) Intertek Group in its "Directory of Building Products."
    - 3) FM Approvals in its "Approval Guide."

## 2.3 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems are to be compatible with one another, with the substrates forming openings, and with penetrating items if any.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. 3M Fire Protection Services.
    - b. Hilti, Inc.
    - c. Tremco Incorporated.
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined in accordance with ASTM E814 or UL 1479.
  1. F-Rating: Not less than the fire-resistance rating of the wall penetrated.
- C. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, in accordance with ASTM E84.
- D. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
  1. Permanent forming/damming/backing materials.
  2. Substrate primers.
  3. Collars.
  4. Steel sleeves.

## 2.4 FILL MATERIALS

- A. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- B. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

- C. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- D. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- E. Intumescent Wrap Strips: Single-component intumescent elastomeric strips for use around combustible penetrants.
- F. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- G. Pillows/Bags: Compressible, removable, and reusable intumescent pillows encased in fire-retardant polyester or glass-fiber cloth. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- H. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- I. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

## 2.5 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
  2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
  3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

### 3.3 INSTALLATION OF PENETRATION FIRESTOPPING SYSTEMS

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
  2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
  3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.
- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

### 3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2174.
- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

### 3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION

SECTION 078443  
JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated construction.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.
2. Section 092216 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Joints in or between fire-resistance-rated construction.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly developed in accordance with current International Firestop Council (IFC) guidelines.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Listed System Designs: For each joint firestopping system, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Approvals according to FM Approvals 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

## 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

## 1.7 COORDINATION

- A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of joints to accommodate joint firestopping systems.

# PART 2 - PRODUCTS

## 2.1 SOURCE LIMITATIONS

- A. Obtain joint firestop systems for each type of joint opening indicated from single manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
  - 1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
  - 2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
    - a. Joint firestop systems installed with products bearing the classification marking of a qualified product certification agency in accordance with Listed System Designs published by a qualified testing agency.
      - 1) UL in its online directory "Product iQ."
      - 2) Intertek Group in its "Directory of Building Products."
- B. Rain/Water Resistance: For perimeter fire-barrier system applications, where inclement weather or greater-than-transient water exposure is expected, use products that dry

rapidly and cure in the presence of atmospheric moisture sufficient to pass ASTM D6904 early rain-resistance test (24-hour exposure).

## 2.3 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems must accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
  - 1. Joint firestopping systems that are compatible with one another, with the substrates forming openings, and with penetrating items, if any.
  - 2. Provide products that, upon curing, do not re-emulsify, dissolve, leach, breakdown, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture.
  - 3. Provide firestop products that do not contain ethylene glycol.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. 3M Fire Protection Services.
    - b. Hilti, Inc.
    - c. Specified Technologies, Inc.
    - d. Tremco Incorporated.
    - e. USG Corporation.
  - 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.
- C. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

## 2.4 ACCESSORIES

- A. Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning: Before installing joint firestopping systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
  - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
  - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
  - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

### 3.3 INSTALLATION

- A. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
  - 1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- C. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
  1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 ft. from end of wall and at intervals not exceeding 30 ft..
- B. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
  1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
  2. Contractor's name, address, and phone number.
  3. Designation of applicable testing agency.
  4. Date of installation.
  5. Manufacturer's name.
  6. Installer's name.

### 3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections in accordance with ASTM E2393.
- B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.
- C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

### 3.6 CLEANING AND PROTECTION

- A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

- B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

END OF SECTION

SECTION 079200  
JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes joint sealants for the following applications:
  - 1. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
    - a. Control and expansion joints on exposed interior surfaces of exterior walls.
    - b. Perimeter joints of exterior openings where indicated.
    - c. Other joints as indicated.
  - 2. Interior joints in the following horizontal traffic surfaces:
    - a. Isolation joints in cast-in-place concrete slabs.
    - b. Other joints as indicated.
- B. Related Sections include the following:
  - 1. Division 9 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

- D. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.
- E. Qualification Data: For Installer.
- F. Field Test Report Log: For each elastomeric sealant application.
- G. Warranties: Special warranties specified in this Section.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

## 1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## 1.7 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: 5 years from date of Substantial Completion.
- C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
  - 1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.

2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

### 2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect & Owner from manufacturer's full range.

### 2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- D. Single-Component Neutral- and Basic-Curing Silicone Sealant :
  1. Type and Grade: S (single component) and NS (nonsag).
  2. Class: 100/50.
  3. Use Related to Exposure: NT (nontraffic).
  4. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
  5. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.

E. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant:

1. Type and Grade: S (single component) and NS (nonsag).
2. Class: 25.
3. Use Related to Exposure: NT (nontraffic).
4. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.
  - a. Use O Joint Substrates: ceramic tile .

F. Multicomponent Nonsag Urethane Sealant :

1. Type and Grade: M (multicomponent) and NS (nonsag).
2. Class: 50.
3. Use Related to Exposure: NT (nontraffic).
4. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

G. Multicomponent Nonsag Urethane Sealant :

1. Type and Grade: M (multicomponent) and NS (nonsag).
2. Class: 25.
3. Uses Related to Exposure: T (traffic) and NT (nontraffic).
4. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.
  - a. Use O Joint Substrates: aluminum coated with a high-performance coating brick.

H. Single-Component Nonsag Urethane Sealant :

1. Type and Grade: S (single component) and NS (nonsag).
2. Class: 25.
3. Uses Related to Exposure: T (traffic) and NT (nontraffic).
4. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

## 2.4 LATEX JOINT SEALANTS

- A. Latex Sealant: Comply with ASTM C 834, Type P, Grade NF.

## 2.5 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) , and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F . Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

## 2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  - 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming

or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

- a. Concrete.
  - b. Masonry.
  - c. Unglazed surfaces of ceramic tile.
3. Remove laitance and form-release agents from concrete.
  4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    - a. Metal.
    - b. Glass.
    - c. Porcelain enamel.
    - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
  2. Do not stretch, twist, puncture, or tear sealant backings.
  3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses in each joint configuration.
  3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
  2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

### 3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed elastomeric sealant joints as follows:
    - a. Perform 10 tests for the first 1000 feet of joint length for each type of elastomeric sealant and joint substrate.
    - b. Perform 1 test for each of joint length thereafter or 1 test per each floor per elevation.
  2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab in Appendix X1 in ASTM C 1193.
    - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; do this by extending cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
  3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
  4. Inspect tested joints and report on the following:
    - a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
    - b. Whether sealants filled joint cavities and are free of voids.
    - c. Whether sealant dimensions and configurations comply with specified requirements.
  5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

### 3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 081113  
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Standard hollow metal doors and frames
  - 2. Positive pressure fire-rated door and frame assemblies, Category A
- B. Related Sections:
  - 1. Division 8 Section "Door Hardware" for door hardware for hollow metal doors.
  - 2. Division 8 Section "Flush Wood Doors" for wood doors.
  - 3. Division 8 Section "Fire Rated Glazing" for vision panels and sidelights.
  - 4. Division 9 Sections "Paints and Coatings" for field painting hollow metal doors and frames and "Gypsum Board Assemblies" for HM framing.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, and finishes.
- B. Shop Drawings: Include the following:
  - 1. Elevations of each door design.
  - 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
  - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  - 4. Locations of reinforcement and preparations for hardware.
  - 5. Details of each different wall opening condition.
  - 6. Details of anchorages, joints, field splices, and connections.

7. Details of accessories.
8. Details of moldings, removable stops, and glazing.

C. Other Action Submittals:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C. Provide Category A assemblies with integral intumescent seals.
1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.
- C. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing in accordance with NFPA 257 or UL 9.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
1. Provide additional protection to prevent damage to finish of factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.
1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

## 1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

## 1.8 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
  - 1. Ceco Door Products; an Assa Abloy Group company.
  - 2. Curries Company; an Assa Abloy Group company.
  - 3. Fleming Door Products Ltd.; an Assa Abloy Group company.
  - 4. Habersham Metal Products Company.
  - 5. Karpen Steel Custom Doors & Frames.
  - 6. Pioneer Industries, Inc.
  - 7. Security Metal Products Corp.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with BFPA 252 or UL 10C. Provide Category A assemblies with integral intumescent seals.
  - 1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.
- B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing in accordance with NFPA 257 or UL 9.

- C. Thermally Rated Door Assemblies: provide door assemblies with U-factor of not more than 0.50 deg Btu/F x h x sq. ft. when tested in accordance with ASTM C1363 or ASTM E1423.
- D. Maximum Air Leakage Door Assemblies: Provide door assemblies with Maximum Air Leakage 1.9 cfm/ft<sup>2</sup> with a minimum test pressure of 1.57 psf per ASTM E283.

## 2.3 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
  - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 152M, Class B
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- G. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- H. Glazing: Comply with requirements in Section 088000 "Glazing."
- I. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 2.4 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A
  - 1. Doors: - n/a
  - 2. Frames:
    - a. Materials: uncoated steel sheet, minimum thickness of 0.053 inch.
    - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
    - c. Construction: Full profile welded.
    - d. Fire-Rated Frames: Category A positive pressure fire-rated, with integral intumescent seals tested per UL 10C, fire ratings indicated on drawings.

## 2.5 BORROWED LITES

- B. Fabricate of uncoated steel sheet, minimum thickness of 0.053 inch.
- C. Construction: Full profile welded.
- D. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.
- E. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

## 2.6 FRAME ANCHORS

- A. Jamb Anchors:
  - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
  - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
  - 3. Post-installed Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to the floor.
- C. Floor Anchors for concrete Slabs with Underlayment: Adjustable-type anchors with extension slips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

- F. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
  - 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

## 2.7 FABRICATION

- A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- B. Positive Pressure Fire Door Frames: Category A with integral intumescent seals tested per UL 10C
- C. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
  - 1. Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding, or by rigid mechanical anchors.
  - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  - 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.
  - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
  - 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
- E. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
  - 1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated
  - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.

3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

## 2.8 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
  1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

### 3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
  - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    - a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    - b. Install frames with removable glazing stops located on secure side of opening.
  - 2. Fire-Rated Openings: Install frames in accordance with NFPA 80, ensuring Category A positive pressure compliance with integral intumescent seals.
  - 3. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
  - 4. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
  - 5. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
    - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
  - 1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8
  - 2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.
  - 3. Smoke-Control Doors: Install doors in accordance with NFPA 105.
- D. Glazing: Comply with installation requirements in Division 8 Section 08800 "Glazing" and with hollow metal manufacturer's written instructions.

### 3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection and prior to 1 year warranty date after substantial completion. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 082113  
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Solid-core doors with wood-veneer faces.
  - 2. Factory fitting flush wood doors to frames and factory machining for hardware.
  - 3. Positive pressure fire doors, UL Category A, as required for fire-rated assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications. For fire-rated doors, include documentation verifying UL Category A compliance for positive pressure fire doors.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
  - 1. Indicate dimensions and locations of mortises and holes for hardware.
  - 2. Indicate dimensions and locations of cutouts.
  - 3. Indicate requirements for veneer matching.
  - 4. Indicate doors to be factory finished and finish requirements.
- C. Samples for Verification:
  - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
  - 2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
    - a. Provide samples for each species of veneer and solid lumber required.
    - b. Finish veneer-faced door samples with same materials proposed for factory-finished doors.

3. Louver blade and frame sections, 6 inches long, for each material and finish specified.
  4. Frames for light openings, 6 inches long, for each material, type, and finish required.
- D. Warranty: Sample of special warranty.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors from single manufacturer.
- B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors." For fire-rated doors, comply with UL Category A for positive pressure fire testing.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

#### 1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
    - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
  2. Warranty Period for Solid-Core Interior Doors: Life of installation.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Wood Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings and temperature-rise limits, based on testing at positive pressure in accordance with NFPA 252. Fire-rated doors shall meet UL Category A requirements for positive pressure fire doors.
  - 1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than **450 deg F** above ambient after 30 minutes of standard fire-test exposure.
- B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

### 2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Graham (as basis of design)
  - 2. Masonite Architectural
  - 3. Buell Door Company Inc.
  - 4. Chappell Door Co.

### 2.3 DOOR CONSTRUCTION, GENERAL

- A. WDMA I.S.1-A Performance Grade:
  - 1. Heavy Duty unless otherwise indicated.

### 2.4 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Doors, Solid-Core Five-Ply Veneer-Faced Doors :
  - 1. Performance Grade: ANSI/WDMA I.S 1A Heavy Duty
  - 2. Architectural Woodwork Standards Quality Grade: Premium.
  - 3. Faces: Single-ply wood veneer not less than 1/50 inch thick
    - a. Species: Red Oak

- b. Cut: Plain sliced (flat sliced).
- c. Finish and color to be selected by owner from manufactures full range of colors.
- d. Match between Veneer Leaves: Book match.
- e. Assembly of Veneer Leaves on Door Faces: Running match.
- f. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
- g. Room Match:
  - 1) Provide door faces of compatible color and grain within each separate room or are of building.
- 4. Exposed Vertical and Top Edges: Same species as faces – Architectural Woodwork Standards edge Type A
  - a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile meeting UL Category A for positive pressure fire doors. Comply with specified requirements for expose vertical edges.
  - b. Fire-Rated Pairs of Doors:
    - 1) Provide formed-steel edges and astragals with intumescent seals.
      - a) Finish steel edges and astragals to match door hardware (locksets of exit devices)
  - c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capacity and split resistance. Comply with specified requirements for exposed edges.
    - 1) Screw-holding capability: 475 lbf in accordance with WDMA T.M. 10.
- 5. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings
  - a. Blocking for Mineral-Core Doors: provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on drawings as needed to eliminate through-bolting hardware.
- 6. Construction: Five plies, hot pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.
- 7. WDMA I.S.1-A Performance Grade: Heavy Duty.

## 2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated.
  - 1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
  - 2. Comply with NFPA 80 requirements for fire-rated doors, including UL Category A for positive pressure fire doors.
- B. Factory machine doors for hardware that is not surface applied.
  - 1. Locate hardware to comply with DHI-WDHS-3.
  - 2. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
  - 3. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
  5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Positive Pressure Fire Door Frames: Category A
- D. Openings: Cut and trim openings through doors in factory.
1. Light Openings: Trim openings with moldings of material and profile indicated.
  2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08800 "Glazing."

## 2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing.
1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
  2. Finish faces, all four edges, edges of cutouts, and mortises.
  3. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Finish doors at factory.
- C. Transparent Finish:
1. Grade: Premium.
  2. Finish: WDMA TR-6 catalyzed polyurethane.
  3. Staining: As selected by Architect & Owner from manufacturer's full range.
  4. Sheen: Satin.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Hardware: For installation, see Division 8 Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
- C. Install frames level, plum, true, and straight.
  - 1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
  - 2. Anchor frames to anchors or blocking built in or directly attached to substrates.
    - a. Secure with countersunk, concealed fasteners and blind nailing.
    - b. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.
      - 1) For factory-finished items, use filler matching finish of items being installed.
  - 3. Install fire-rated doors and frame in accordance with NFPA 80.
  - 4. Install smoke- and draft-control doors in accordance with NFPA 105.
- D. Job-Fitted Doors:
  - 1. Align and fit doors in frames with uniform clearances and bevels as indicated below;
    - a. Do not trim stiles and rails in excess of limits set by manufacturer.
  - 2. Machine doors for hardware.
  - 3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
  - 4. Clearances:
    - a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
    - b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated.
    - c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
    - d. Comply with NFPA 80 for fire-rated doors.
  - 5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
  - 6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

### 3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.

- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 087100  
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hardware for fire-rated doors.

1.02 RELATED REQUIREMENTS

- A. Section 081113 - Hollow Metal Doors and Frames.
- B. Section 081416 - Flush Wood Doors.
- C. Section 284600 - Fire Detection and Alarm: Electrical connection to release magnetic holders.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. BHMA A156.1 - Standard for Butts and Hinges; 2021.
- C. BHMA A156.2 - Bored and Preamsembled Locks and Latches; 2022.
- D. BHMA A156.3 - Exit Devices; 2020.
- E. BHMA A156.4 - Door Controls - Closers; 2019.
- F. BHMA A156.5 - Cylinders and Input Devices for Locks; 2020.
- G. BHMA A156.6 - Standard for Architectural Door Trim; 2021.
- H. BHMA A156.7 - Template Hinge Dimensions; 2016.
- I. BHMA A156.15 - Release Devices - Closer Holder, Electromagnetic and Electromechanical; 2021.
- J. BHMA A156.16 - Auxiliary Hardware; 2018.
- K. BHMA A156.28 - Standard for Recommended Practices for Mechanical Keying Systems; 2018.
- L. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2016.
- M. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames; 2006.
- N. DHI (H&S) - Sequence and Format for the Hardware Schedule; 2019.
- O. DHI (KSN) - Keying Systems and Nomenclature; 2019.
- P. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- Q. ITS (DIR) - Directory of Listed Products; Current Edition.
- R. NFPA 80 – 2019 Standard for Fire Doors and Other Opening Protectives.
- S. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2022.
- T. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.
- U. UL (DIR) - Online Certifications Directory; Current Edition.
- V. UL 10C – 2016 Positive Pressure Fire Tests of Door Assemblies
- W. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
- B. Sequence installation to ensure facility services connections are achieved in an orderly and expeditious manner.
- C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; require attendance by affected installers and the following:
  - 1. Architect.
  - 2. Installer's Architectural Hardware Consultant (AHC).
  - 3. Hardware Installer.
  - 4. Owner's Security Consultant.
- D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
- E. Keying Requirements Meeting:
  - 1. Attendance Required:
    - a. Owner.
    - b. Architect.
  - 2. Agenda:
    - a. Establish keying requirements.
    - b. Verify locksets and locking hardware are functionally correct for project requirements.
    - c. Verify that keying and programming complies with project requirements.
    - d. Establish keying submittal schedule and update requirements.
  - 3. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system.
  - 4. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
  - 5. Deliver established keying requirements to manufacturers.

#### 1.05 SUBMITTALS

- A. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
- B. Shop Drawings - Door Hardware Schedule: A detailed listing that includes each item of hardware to be installed on each door.
  - 1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
  - 2. Comply with DHI (H&S) using door numbering scheme and hardware set numbers as indicated in Contract Documents.
    - a. Submit in vertical format.
  - 3. Include complete description for each door listed.
- C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- D. Manufacturer's qualification statement.
- E. Installer's qualification statement.
- F. Supplier's qualification statement.

- G. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
- H. Keying Schedule:
  - 1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.
- I. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Include the following:
  - 1. System schematic
  - 2. Point-to-point wiring diagram,
  - 3. Riser diagram
  - 4. Elevation of each door
- J. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- K. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.
- L. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.

#### 1.06 QUALITY ASSURANCE

- A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.
- D. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

#### 1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide manufacturer warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.
  - 1. Closers: Thirty five years, minimum.
  - 2. Exit Devices: Five years, minimum.
  - 3. Locksets: Ten years, minimum.

### PART 2 PRODUCTS

#### 2.01 GENERAL REQUIREMENTS

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.

C. Closers:

1. Provide door closer on each exterior door, unless otherwise indicated.
2. Provide door closer on each fire-rated and smoke-rated door.
3. Spring hinges are not an acceptable self-closing device, unless otherwise indicated.

D. Fasteners:

1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
  - a. Aluminum fasteners are not permitted.
  - b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
  - a. Self-drilling (Tek) type screws are not permitted.
3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
4. Provide wall grip inserts for hollow wall construction.
5. Fire-Resistance-Rated Applications: Comply with NFPA 80.
  - a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
  - b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

- E. Gasketing: Where gasketing is provided, products shall be required to maintain the specified UL 1784 and door rating.

## 2.02 PERFORMANCE REQUIREMENTS

A. Provide door hardware products that comply with the following requirements:

1. Applicable provisions of federal, state, and local codes.
2. Accessibility: ADA Standards and ICC A117.1.
3. Fire-Resistance-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
4. Hardware on Fire-Resistance-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.
5. Hardware for Smoke and Draft Control Doors: Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.
6. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
7. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
8. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

## 2.03 HINGES

A. Manufacturers: Conventional butt hinges.

1. BEST; dormakaba Group
2. Hager

3. Ives
  4. McKinney
- B. Properties:
1. Butt Hinges: As applicable to each item specified.
    - a. Standard Weight Hinges: Minimum of two (2) permanently lubricated non-detachable bearings.
    - b. Heavy Weight Hinges: Minimum of four (4) permanently lubricated bearings on heavy weight hinges.
    - c. Template screw hole locations.
    - d. Bearing assembly installed after plating.
    - e. Bearings: Exposed fully hardened bearings.
    - f. Bearing Shells: Shapes consistent with barrels.
    - g. Pins: Easily seated, non-rising pins.
      - 1) Fully plate hinge pins.
      - 2) Non-Removable Pins: Slotted stainless steel screws.
    - h. UL 10C listed for fire-resistance-rated doors.
- C. Sizes: See Door Hardware Schedule.
1. Hinge Widths: As required to clear surrounding trim.
  2. Sufficient size to allow 180 degree swing of door.
- D. Finishes: See Door Hardware Schedule.
1. Fully polish hinges; front, back, and barrel.
- E. Grades:
1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
- F. Material: Base metal as indicated for each item by BHMA material and finish designation.
- G. Types:
1. Butt Hinges: Include full mortise hinges.
- H. Options: As applicable to each item specified.
- I. Quantities:
1. Butt Hinges: Three (3) hinges per leaves up to 90 inches (2286 mm) in height. Add one (1) for each additional 30 inches (762 mm) in height or fraction thereof.
    - a. Hinge weight and size unless otherwise indicated in hardware sets:
      - 1) For doors up to 36 inches (914 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.134 inch (3.4 mm) and a minimum of 4-1/2 inches (114 mm) in height.
      - 2) For doors from 36 inches (914 mm) wide up to 42 inches (1067 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.145 inch (3.7 mm) and a minimum of 4-1/2 inches (114 mm) in height.
      - 3) For doors from 42 inches (1067 mm) wide up to 48 inches (1219 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.180 inch (4.6 mm) and a minimum of 5 inches (127 mm) in height.
      - 4) For doors greater than 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.180 inch (4.6 mm) and a minimum of 5 inches (127 mm) in height.

- J. Applications: At swinging doors.
  - 1. Provide non-removable pins at out-swinging doors with locking hardware and all exterior doors.
- K. Products:
  - 1. Butt Hinges:
    - a. Ball Bearing, Five (5) Knuckle.

## 2.04 EXIT DEVICES

- A. Manufacturers:
  - 1. BEST, dormakaba Group
  - 2. Sargent, AN Assa Abloy company
  - 3. Von Duprin; an Allegio company
  - 4. Corbin Russwin
- B. Properties:
  - 1. Actuation: Full-length touchpad.
  - 2. Touchpads: 'T' style metal touchpads and rail assemblies with matching chassis covers end caps.
  - 3. Latch Bolts: Stainless steel deadlocking with 3/4 inch (19 mm) projection using latch bolt.
  - 4. Lever Design: Match project standard lockset trims.
  - 5. Cylinder: Include where cylinder dogging or locking trim is indicated.
  - 6. Strike as recommended by manufacturer for application indicated.
  - 7. Sound dampening on touch bar.
  - 8. Touch bar assembly on wide style exit devices to have a 1/4 inch (6.3 mm) clearance to allow for vision frames.
  - 9. All exposed exit device components to be of architectural metals and "true" architectural finishes.
  - 10. Handing: Field-reversible.
  - 11. Fasteners on Back Side of Device Channel: Concealed - exposed fasteners not allowed.
  - 12. Vertical Latch Assemblies' Operation: Gravity, without use of springs.
- C. Grades: Complying with BHMA A156.3, Grade 1.
  - 1. Provide exit devices tested and certified by UL or by a recognized independent laboratory for mechanical operational testing to 10 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.
- D. Products:
  - 1. 2000.

## 2.05 REMOVABLE MULLIONS

- A. Manufacturers:
  - 1. BEST, dormakaba Group: [www.bestaccess.com/#sle](http://www.bestaccess.com/#sle).
  - 2. Assa Abloy
  - 3. Von Duprin
  - 4. Precision Hardware
- B. Properties:
  - 1. Rectangular shape 3 inches (76 mm) by 2 inches (51 mm) tubes with minimum 1/8 inch (3.2 mm) wall thickness.
  - 2. Furnished by the same manufacturer as exit devices.

3. Pre-drilled holes for installation of exit device strikes.
  4. Spacers: Provide as required for proper installation, based on frame profile and dimensions.
- C. Grades: Complying with BHMA A156.3.
- D. Materials: Manufacturer's standard for items specified.
1. Top and Bottom Brackets: Investment-cast steel.
- E. Options:
1. Furnish Keyed Removable "KR" feature and corresponding cylinders as specified.
    - a. Mullions capable of being installed without physical key present.
    - b. Physical key required to operate.
- F. Applications: As indicated on drawings and in Door Hardware Schedule.
- G. Products:
1. 822 Series.

## 2.06 LOCK CYLINDERS

- A. Manufacturers:
1. Corbin Russwin Pyramid – No Substitutions
- B. Properties:
1. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
    - a. Provide cylinders from same manufacturer as locking device.
    - b. Provide cams and/or tailpieces as required for locking devices.
    - c. Provide cylinders with appropriate format interchangeable cores where indicated.
- C. Grades:
1. Standard Security Cylinders: Comply with BHMA A156.5.
- D. Material:
1. Manufacturer's standard corrosion-resistant brass alloy.
- E. Types: As applicable to each item specified.
- F. Applications: At locations indicated in hardware sets, and as follows
1. As required for items with locking devices provided by other sections, including at elevator controls and cabinets.
    - a. When provisions for lock cylinders are referenced elsewhere in the Project Manual to this Section, provide compatible type of lock cylinder, keyed to building keying system, unless otherwise indicated.
- G. Products:
1. Rim/mortise.

## 2.07 CYLINDRICAL LOCKS

- A. Manufacturers:
1. Corbin Russwin CL3100 – No Substitutions
- B. Properties:
1. Mechanical Locks:
    - a. Fitting modified ANSI A115.2 door preparation.
    - b. Door Thickness Fit: 1-3/8 inches (35 mm) to 2-1/4 inches (57 mm) thick doors.

- c. Construction: Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.
  - 1) Through-bolted anti-rotational studs.
- d. Cast stainless steel latch retractor with roller bearings for exceptionally smooth operation and superior strength and durability.
- e. Bored Hole: 2-1/8 inch (54 mm) diameter.
- f. Backset: 2-3/4 inches (70 mm) unless otherwise indicated.
- g. Latch: Single piece tail-piece construction.
  - 1) Latchbolt Throw: 9/16 inch (14.3 mm), minimum.
- h. Cylinders:
  - 1) Cylinder Core Types: Locks capable of supporting manufacturers' cores, as applicable.
    - (a) Small format interchangeable.
- i. Lever Trim:
  - 1) Style: See Door Hardware Schedule.
  - 2) Functionality: Allow the lever handle to move up to 45 degrees from horizontal position prior to engaging the latchbolt assembly.
  - 3) Strength: Locksets outside locked lever designed to withstand minimum 1,400 inch-lbs. (158.2 Nm) of torque. In excess of that, a replaceable part will shear. Key from outside and/or inside lever will still operate lockset.
  - 4) Independent spring mechanism for each lever.
    - (a) Contain lever springs in the main lock hub.
  - 5) Outside Lever Sleeve: Seamless one-piece construction.
  - 6) Keyed Levers: Removable only after core is removed by authorized control key.
- C. Finishes: See Door Hardware Schedule.
  - 1. Core Faces: Match finish of lockset.
- D. Grades: Comply with BHMA A156.2, Grade 1, Series 4000, Operational Grade 1, Extra Heavy Duty.
  - 1. Durability: Passing 50 Million cycle tests verified by third party testing agency.
- E. Material: Manufacturer's standard for specified lock.
  - 1. Critical Latch and Chassis Components: Brass or corrosion-resistance treated steel.
  - 2. Outside Lever Sleeve: Hardened steel alloy.
- F. Products: Cylindrical locks, including mechanical and electrified types.
  - 1. 9K (Grade 1).

## 2.08 CLOSERS

- A. Manufacturers:
  - 1. BEST, dormakaba Group
  - 2. Dormakaba; dormakaba Group
  - 3. LCN
  - 4. Norton
  - 5. Sargent
- B. Properties:
  - 1. Surface Mounted Closers: Manufacturer's standard.
    - a. Construction: Single piece casted cast iron housing.

- b. Maximum Projection from Face of Door: 2-7/16 inches (62 mm).
- c. Mechanism: Separate, tamper-resistant, retention ring, self-regulating adjusting valves for closing and latching speeds, backcheck, advanced variable backcheck and optional delayed action feature.
  - 1) All valve adjustment socket screw drives must be slotted hex not requiring special tools for maintenance or adjustments.
  - 2) Spring adjustment screw must be hex key.
  - 3) All valves must have mechanism to prevent oil leaks from over adjustment.
  - 4) All closer adjustments must be front facing and adjustable without removing closer from installed surface.
  - 5) Advanced Variable Backcheck: Backcheck positioning adjustment (POS)
    - (a) Selectable adjustment to facilitate degree of backcheck engagement point:
      - (1) Parallel arm mount: 50 degrees.
      - (2) Regular arm and top jamb mount: Between 50 and 80 degrees.
    - (b) Intensity of backcheck shall be fully adjustable with tamper resistant non-critical valve screw.
  - 6) Spring Size:
    - (a) Adjustable spring sizes 1-6 with +50% power increase capability.
    - (b) Spring size indicator shall be easy to read, located front facing on the housing and adjustable without removal of housing from the installed surface.
- d. Hydraulic: All-weather fluid.
- e. Arm Assembly:
  - 1) Construction: Stamped arms and forged hub.
  - 2) Material: Steel.
  - 3) Degree of Swing:
    - (a) Parallel arm NHO mounting shall not limit opening angle and permit 180-degree door swing.
    - (b) Regular arm NHO mounting shall not limit opening angle and permit 120-degree door swing.
    - (c) Consult factory for non-standard templating.
  - 4) Include hold-open, integral stop, or spring-loaded stop feature, as specified in Door Hardware Schedule.
  - 5) Where obstructions limit opening angle and wall or floor stops are prohibited, provide "IS" or "S-IS" arms.
- f. Covers:
  - 1) Type:
    - (a) Full. (standard)
  - 2) Material:
    - (a) Plastic. (standard)
  - 3) Finish:
    - (a) Painted. (standard)
  - 4) Attachment: Two-point flange mounting, dual-clamp friction fit closer cover.

C. Grades:

- 1. Closers: Comply with BHMA A156.4, Grade 1.
  - a. Underwriters Laboratories Compliance:

- 1) Product Listing: UL (DIR) and ULC for use on fire-resistance-rated doors.
  - (a) CAN/ULC S-133 - Standard Method Of Tests For Door Closers Intended For Use With Swinging Doors.
  - b. Testing Standards Compliance: Meeting requirements of UL 10C for positive pressure.
- D. Code Compliance: As required by authorities having jurisdiction in the State in which the Project is located.
- E. Options:
  1. Delayed action, adjustable with an independent valve.
- F. Installation:
  1. Mounting: Includes surface mounted installations.
  2. Mount closers on non-public side of door and stair side of stair doors unless otherwise noted in hardware sets.
  3. At out swinging exterior doors, mount closer on interior side of door.
  4. Provide adapter plates, shim spacers, and blade stop spacers as required by frame and door conditions.
  5. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.
- G. Products:
  1. Surface Mounted:
    - a. EHD9000

## 2.09 PROTECTION PLATES

- A. Manufacturers:
  1. Don-Jo
  2. Trimco: [www.trimcohardware.com/#sle](http://www.trimcohardware.com/#sle)
  3. Burns
  4. Hiawatha
  5. Rockwood
- B. Properties:
  1. Plates:
    - a. Kick Plates: Provide along bottom edge of push side of every wood door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
    - b. Edges: Beveled, on four (4) unless otherwise indicated.
- C. Grades: Comply with BHMA A156.6.
- D. Material: As indicated for each item by BHMA material and finish designation.
  1. Metal Properties: Stainless steel.
- E. Installation:
  1. Fasteners: Countersunk screw fasteners

## 2.10 STOPS AND HOLDERS

- A. Manufacturers:
  1. ABH
  2. Trimco: [www.trimcohardware.com/#sle](http://www.trimcohardware.com/#sle)
  3. Ives

- 4. Burns
- B. General: Provide overhead stop/holder when wall or floor stop is not feasible.
- C. Grades:
  - 1. Door Holders, Wall Bumpers, and Floor Stops: Comply with BHMA A156.16 and Resilient Material Retention Test as described in this standard.
- D. Material: Base metal as indicated for each item by BHMA material and finish designation.
- E. Types:
  - 1. Wall Bumpers: Bumper, concave, wall stop.
- F. Installation:
  - 1. Non-Masonry Walls: Confirm adequate wall reinforcement has been installed to allow lasting installation of wall bumpers.
- G. Products:
  - 1. Wall Bumpers.

## 2.11 ELECTROMAGNETIC DOOR HOLDERS

- A. Manufacturers:
  - 1. dormakaba; dormakaba Group: [www.dormakaba.com/us-en/#sle](http://www.dormakaba.com/us-en/#sle).
  - 2. BEST, dormakaba Group: [www.bestaccess.com/#sle](http://www.bestaccess.com/#sle)
  - 3. RCI; dormakaba Group: [www.dormakaba.com/us-en/#sle](http://www.dormakaba.com/us-en/#sle)
  - 4. Architectural Builders Hardware Mfg (ABH): [www.wbhmfg.com/sle](http://www.wbhmfg.com/sle)
  - 5. LCN
- B. Properties:
  - 1. Holding Force, Standard Duty: 40 lbs.-force (177 N), minimum.
  - 2. Power Loss Status: Fail safe; door released to close.
  - 3. Life Safety Interface: With fire detectors, fire-alarm system, and smoke detectors for fire-resistance-rated door assemblies.
- C. Grades: Comply with BHMA A156.15.
- D. Types: Wall mounted, single unit, standard duty, with strike plate attached to door.
- E. Options: As applicable to each item specified.
  - 1. Voltage: 12 VDC.
- F. Products:
  - 1. EM Series.

## 2.12 MISCELLANEOUS ITEMS

- A. Manufacturers:
  - 1. Pemko
  - 2. Hagar Companies
  - 3. Rockwood Manufacturing Company
  - 4. ABH Manufacturing
  - 5. Burns Manufacturing
  - 6. Don-Jo
  - 7. Stanley Commercial hardware
  - 8. Trimco
- B. Properties:

1. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
  - a. Single Door: Provide three on strike jamb of frame.
  - b. Pair of Doors: Provide two on head of frame, one for each door at latch side.
  - c. Material: Rubber, gray color.
2. Gasketing: Where gasketing is provided, products shall be required to maintain the specified UL 1784 and door rating.

C. Products:

1. Silencers.

## 2.13 KEYS AND CORES

A. Manufacturers:

1. Corbin Russwin (Match existing)
2. BEST
3. Dormakaba

B. Properties: Complying with guidelines of BHMA A156.28.

1. Provide small format interchangeable core.
2. Provide Patented CORMAX keys and cores.
3. Provide keying information in compliance with DHI (KSN) standards.
4. Keying Schedule: Arrange for a keying meeting, with Architect, Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying complies with project requirements.
5. Keying: Master keyed.
6. Include construction keying and control keying with removable core cylinders.
7. Supply keys in following quantities:
  - a. Master Keys: 4 each.
  - b. Construction Master Keys: 6 each.
  - c. Construction Keys: 15 each.
  - d. Construction Control Keys: 2 each.
  - e. Control Keys if New System: 2 each.
8. Provide key collection envelopes, receipt cards, and index cards in quantity suitable to manage number of keys.
9. Deliver keys with identifying tags to Owner by security shipment direct from manufacturer.
10. Permanent Keys and Cores: Stamped with applicable key marking for identification. Do not include actual key cuts within visual key control marks or codes. Stamp permanent keys "Do Not Duplicate."
11. Include installation of permanent cores and return construction cores to hardware supplier. Construction cores and keys to remain property of hardware supplier.

C. Products:

1. Patented:
  - a. CORMAX.

## 2.14 FINISHES

A. Finishes: Identified in Hardware Sets.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.
- B. Correct all defects prior to proceeding with installation.
- C. Verify that electric power is available to power operated devices and of correct characteristics.

### 3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Install hardware using the manufacturer's fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use "Riv-Nuts" or similar products.
- C. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.
- D. Install hardware for smoke and draft control doors in accordance with NFPA 105.
- E. Use templates provided by hardware item manufacturer.
- F. Do not install surface mounted items until application of finishes to substrate are fully completed.
- G. Wash down masonry walls and complete painting or staining of doors and frames.
- H. Complete finish flooring prior to installation of thresholds.
- I. Include in installation for existing doors and frames any necessary field modification and field preparation of doors and frames for new hardware. Provide necessary fillers, reinforcements, and fasteners for mounting new hardware and to cover existing door and frame preparations.

### 3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing under provisions of Section 014000 - Quality Requirements.

### 3.04 ADJUSTING

- A. Adjust work under provisions of Section 017000 - Execution and Closeout Requirements.
- B. Adjust hardware for smooth operation.
- C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

### 3.05 CLEANING

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.
- B. Clean adjacent surfaces soiled by hardware installation activities.
- C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

### 3.06 PROTECTION

- A. Protect finished Work under provisions of Section 017000 - Execution and Closeout Requirements.

- B. Do not permit adjacent work to damage hardware or finish.

### 3.07 HARDWARE SCHEDULE

#### Manufacturer list

ABH	Architectural Builders Hardware
BES	BEST
CR	Corbin Russwin
PRE	BEST (Precision)
D-J	DON-JO
DKA	dormakaba Architectural
NGP	National Guard Products

#### Option list

Code:	Name:
B4E	Beveled 4 Edges
CSK	Countersunk Holes
FL	Fire Rated Hardware
S3	ANSI 4 7/8" Strike

#### Finish list

Code:	Name:
26D	Satin Chrome
626	Satin Chrome
630	Satin Stainless Steel
689	Aluminum
C	Charcoal
Gray	Gray Silicone

## Specification Report

### Set #1

Doors: C103, C113, C112, C115, C114, C116, C117, C118, C119, C126, C128, C130, C132, C134, C136, C138, C140, C141

3	Hinge	FBB179 45X45	26D	BES
1	Cylindrical Lock	CL3151	626	CR
1	Door Closer	EHD90 16 AF90P	689	BES
1	Protection Plate	90 10" 2" LDW CSK B4E	630	D-J
1	Gasketing	5050 Head & Jambs (2)	C	NGP
1	Wall Stop	AB403	630	ABH

### Set #2

Doors: C107, C107B

3	Hinge	FBB179 45X45	26D	BES
1	Cylindrical Lock	CL3157	626	CR
1	Door Closer	EHD90 16 AF90P	689	BES
1	Protection Plate	90 10" 2" LDW CSK B4E	630	D-J
1	Gasketing	5050 Head & Jambs (2)	C	NGP
1	Wall Stop	AB403	630	ABH

### Set #3

Doors: C107A, C111.2

3	Hinge	FBB179 45X45	26D	BES
1	Cylindrical Lock	CL3110	626	CR
1	Door Closer	EHD90 16 AF90P	689	BES
1	Protection Plate	90 10" 2" LDW CSK B4E	630	D-J
1	Gasketing	5050 Head & Jambs (2)	C	NGP
1	Wall Stop	AB403	630	ABH

### Set #4

Doors: C107.1

3	Hinge	FBB179 45X45	26D	BES
1	Cylindrical Lock	CL3152	626	CR
1	Door Closer	EHD90 16 AF90P	689	BES
1	Protection Plate	90 10" 2" LDW CSK B4E	630	D-J

1	Gasketing	5050 Head & Jambs (2)	C	NGP
1	Wall Stop	AB403	630	ABH

### Set #5

Doors: C108

3	Hinge	FBB179 45X45	26D	BES
1	Privacy Set	CL3120	626	CR
1	Door Closer	EHD90 16 AF90P	689	BES
1	Protection Plate	90 10" 2" LDW CSK B4E	630	D-J
1	Gasketing	5050 Head & Jambs (2)	C	NGP
1	Wall Stop	AB403	630	ABH

### Set #6

Doors: C106

3	Hinge	FBB179 45X45	26D	BES
1	Exit Device	FL 2108 4908 D	630	PRE
1	Rim Cylinder	3037 CL3108	626	CR
1	Door Closer	EHD90 16 AF90P	689	BES
1	Protection Plate	90 10" 2" LDW CSK B4E	630	D-J
1	Gasketing	5050 Head & Jambs (2)	C	NGP
1	Wall Stop	AB403	630	ABH

### Set #7

Doors: C111.1

6	Hinge	FBB179 45X45	26D	BES
1	Keyed Removeable Mullion	FLKR822	689	PRE
2	Exit Device	FL 2108 4908 D	630	PRE
3	Rim Cylinder	3037 CL3108	626	CR
2	Door Closer	EHD90 16 AF90P	689	BES
2	Protection Plate	90 10" 1" LDW CSK B4E	630	D-J
2	Magnetic Door Holder	EM 501-24120	689	DKA
1	Gasketing	5050 Head & Jambs (2)	C	NGP
1	Gasketing	5100N Mullion		NGP

## Set #8

Doors: C111.3

3	Hinge	FBB179 45X45	26D	BES
1	Exit Device	2114 4914 D	630	PRE
1	Door Closer	EHD90 16 AF90P	689	BES
1	Protection Plate	90 10" 2" LDW CSK B4E	630	D-J
3	Silencer	1608	Gray	D-J
1	Wall Stop	AB403	630	ABH

Opening No.:	Hardware Set:
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C103	1
C106	6
C107	2
C107.1	4
C107A	3
C107B	2
C108	5
C111.1	7
C111.2	3
C111.3	8
C112	1
C113	1
C114	1
C115	1
C116	1
C117	1
C118	1
C119	1
C126	1
C128	1
C130	1
C132	1
C134	1
C136	1
C138	1
C140	1
C141	1

END OF SECTION

SECTION 088000  
GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass products.
2. Glazing sealants.
3. Glazing tapes.
4. Miscellaneous glazing materials.

B. Related Requirements:

1. Section 088813 "Fire-Rated Glazing."

1.2 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer manufacturers of fabricated glass units .
- B. Product Certificates: For glass.
- C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.
  - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

## 1.7 QUALITY ASSURANCE

- A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.
- B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

## 1.9 WARRANTY

- A. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period. Coverage for any other cause is excluded.

- 1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations for Glass: Obtain tinted and coated glass from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
  - 1. For monolithic-glass lites, properties are based on units with lites 6 mm thick .

### 2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
  - 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."

3. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
  - C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
    1. Minimum Glass Thickness for Exterior Lites: 6 mm .
    2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
  - D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

## 2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Guardian Glass LLC.
    - b. Pilkington North America; NSG Group.
    - c. Vitro Architectural Glass.
- B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
  1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- C. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
  1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

## 2.5 GLAZING SEALANTS

### A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

### B. Neutral-Curing Silicone Glazing Sealant, Complying with ASTM C920, Type S, Grade NS, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Pecora Corporation.
  - b. Sika Corporation.
  - c. The Dow Chemical Company.
  - d. Tremco Incorporated.

## 2.6 GLAZING TAPES

### A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

### B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

## 2.7 MISCELLANEOUS GLAZING MATERIALS

### A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing

materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks:
  - 1. Silicone with Shore A durometer hardness of 85, plus or minus 5.
  - 2. Type recommended in writing by sealant or glass manufacturer.
- D. Spacers:
  - 1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
  - 2. Type recommended in writing by sealant or glass manufacturer.
- E. Edge Blocks:
  - 1. Silicone with Shore A durometer hardness per manufacturer's written instructions.
  - 2. Type recommended in writing by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

## 2.8 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
  - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
    - a. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces .
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  2. Presence and functioning of weep systems.
  3. Minimum required face and edge clearances.
  4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

### 3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

#### 3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- G. Apply cap bead of elastomeric sealant over exposed edge of tape.

#### 3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

### 3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

### 3.7 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
  - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

### 3.8 MONOLITHIC GLASS SCHEDULE

A. Clear Glass Type : Annealed Heat-strengthened Fully tempered float glass.

1. Minimum Thickness: 6 mm .
2. Safety glazing required.
3. Provide decorative film overlay where indicated.

END OF SECTION

SECTION 088813  
FIRE-RATED GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Fire-protection-rated glazing.

1.2 DEFINITIONS

- A. Fire-Protection-Rated Glazing: Glazing that prevents spread of fire and smoke and complies with requirements for rated openings; incapable of blocking radiant heat
- B. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- C. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product; 12 inches square.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and glass testing agency.
- B. Product Certificates: For each type of glass and glazing product.
- C. Sample Warranties: For special warranties.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the NGA's Certified Glass Installer Program.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

## 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during remainder of construction period.

## 1.9 WARRANTY

- A. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: Five 10 years from date of Substantial Completion.

- B. Manufacturer's Special Warranty for Tempered Glazing Units with Clear Intumescent Interlayer: Manufacturer agrees to replace units that deteriorate within specified warranty period. Deterioration of tempered glazing units with clear intumescent interlayer is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning glass contrary to manufacturer's written instructions. Evidence of failure is air bubbles within units, or obstruction of vision by contamination or deterioration of intumescent interlayer.

1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 SOURCE LIMITATIONS

- A. Glass: For each glass type, obtain from single source from single manufacturer.

- B. Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

## 2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

- 1. NGA Publications: "Glazing Manual."

- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC . Label shall indicate manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

## 2.4 GLASS PRODUCTS

- A. Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

- B. Low-Iron Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear), with visible light transmission not less than 91 percent.

- C. Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class I (clear) unless otherwise indicated, Quality-Q3.

- 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

- D. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

- 1. Construction: Laminate glass with polyvinyl butyral interlayer unless fire-protection or fire-resistance rating is based on another product.
  - 2. Interlayer Thickness: Provide thickness as needed to comply with requirements.
  - 3. Interlayer Color: Clear unless otherwise indicated.

## 2.5 FIRE-PROTECTION-RATED GLAZING

- A. General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing in accordance with NFPA 257 or UL 9, including hose-stream test, and shall comply with NFPA 80.
  - 1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from hose-stream test.
- B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether glazing has passed hose-stream test; whether glazing meets 450 deg F temperature-rise limitation; and fire-resistance rating in minutes.
  - 1. Fire-rated glazing shall bear a label or other identification showing the name of the manufacturer, the test standard and information required in VCC Table 716.1(1) that shall be issued by an approved agency and shall be permanently identified on the glazing.
  - 2. For fire-protection-rated glazing, the label shall bear the following identification required in VCC Tables 716.1(1) and 716.1(3): "OH-XXX." "OH" indicates that the glazing meets both the fire protection and the hose-stream requirements of NFPA 257 or UL 9 and is permitted to be used in fire window openings. The placeholder "XXX" represents the fire-rating period, in minutes.
- C. 20-Min D-20 Fire-Protection-Rated Tempered Glass (GL-2) : 6-mm thickness; fire-protection-rated tempered glass; complying with 16 CFR 1201, Category II.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. McGrory Glass, Inc.
    - b. SAFTI FIRST Fire Rated Glazing Solutions. (SuperLite I)
    - c. Technical Glass Products; an Allegion brand.
    - d. Vetrotech Saint-Gobain.
- D. 45-Min D-H-OH-45 Fire-Protection-Rated Tempered Glass (GL-3) : 19-mm thickness; fire-protection-rated tempered glass; complying with 16 CFR 1201, Category II.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. McGrory Glass, Inc.
    - b. SAFTI FIRST Fire Rated Glazing Solutions. (SuperClear 45-HS-LI)
    - c. Technical Glass Products; an Allegion brand.
    - d. Vetrotech Saint-Gobain.
- E. 45-Min OH-45 or W-60 Fire-Protection Tempered Glass (GL-4); fire-protection-rated tempered glass; complying with 16 CFR 1201, Category II.

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
  - a. McGrory Glass, Inc.
  - b. SAFTI FIRST Fire Rated Glazing Solutions. (SuperClear 45-HS-LI)
  - c. Technical Glass Products; an Allegion brand.
  - d. Vetrotech Saint-Gobain.

## 2.6 GLAZING ACCESSORIES

- A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.
- B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.
  1. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.
- C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
  1. AAMA 804.3 tape, where indicated.
  2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
  3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- D. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
  1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
  2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

## 2.7 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing

materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

- B. Perimeter Insulation for Fire-Resistance-Rated Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

## 2.8 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed Work.

### 3.3 GLAZING, GENERAL

- A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.
- B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- I. Set glass lites with proper orientation so that coatings face fire side or protected side as specified.

### 3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

- G. Apply cap bead of elastomeric sealant over exposed edge of tape.

### 3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop, so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- D. Install gaskets so they protrude past face of glazing stops.

### 3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

### 3.7 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
  - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION

SECTION 092216  
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board ceilings

1.2 Related Requirements

- A. Section 05 40 00 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses

1.3 ACTION SUBMITTALS

- A. Product Data: For each product.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.
- B. Evaluation reports for high-strength steel studs and tracks firestop tracks post-installed anchors and power-actuated fasteners.

1.5 QUALITY ASSURANCE

- A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association the Steel Stud Manufacturers Association or the Supreme Steel Framing System Association.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical

to those tested in assembly indicated, in accordance with ASTM E119 by an independent testing agency.

## 2.2 FRAMING SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. CEMCO; California Expanded Metal Products Co
  - 2. ClarkDietrich Building Systems
  - 3. Marino\WARE
  - 4. SCAFCO Steel Stud Company
- B. Framing Members, General: Comply with AISI S220 for conditions indicated.
  - 1. Steel Sheet Components: Comply with AISI S220 requirements for metal unless otherwise indicated
  - 2. Protective Coating: Comply with AISI S220; ASTM A653/A653M, G40; or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.
- C. Studs and Track: AISI S220.
  - 1. Minimum Base-Steel Thickness: 0.0329 inch.
  - 2. Depth: As indicated on Drawings .
- D. High-Strength Steel Studs and Tracks: Roll-formed with surface deformations to stiffen the framing members.
  - 1. Minimum Base-Steel Thickness: As required by horizontal deflection performance requirements 0.0180 inch 0.0190 inch .
  - 2. Depth: As indicated on Drawings .
- E. Slip-Type Head Joints: Where indicated, provide the following:
  - 1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 2-inch minimum vertical movement.
  - 2. Single Long-Leg Track System: Top track with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
  - 3. Double-Track System: Top outer tracks, inside track with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
  - 4. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

- F. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- G. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  - 1. Minimum Base-Steel Thickness: 0.0329 inch .
- H. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch- wide flanges.
  - 1. Depth: As indicated on Drawings .
  - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- I. Hat-Shaped, Rigid Furring Channels:
  - 1. Minimum Base-Steel Thickness: 0.0329 inch .
  - 2. Depth: As indicated on Drawings .
- J. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
  - 1. Configuration: Asymmetrical or hat shaped.
- K. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.
  - 1. Depth: As indicated on Drawings .
  - 2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
  - 3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- L. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 3/4 inch, minimum uncoated-steel thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

## 2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Hanger Attachments to Concrete:
  - 1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 AC193 AC58 or AC308 as appropriate for the substrate.
    - a. Uses: Securing hangers to structure.

- b. Type: Torque-controlled, expansion anchor torque-controlled, adhesive anchor or adhesive anchor.
    - c. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
    - d. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.
  - C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
  - D. Flat Hangers: Steel sheet, in size indicated on Drawings .
  - E. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.
    - 1. Depth: As indicated on Drawings .
  - F. Furring Channels (Furring Members):
    - 1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
    - 2. Steel Studs and Tracks: Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.
      - a. Minimum Base-Steel Thickness: 0.0329 inch.
      - b. Depth: As indicated on Drawings .
    - 3. High-Strength Steel Studs and Tracks:
      - a. Minimum Base-Steel Thickness: 0.0190 inch. .
      - b. Depth: As indicated on Drawings .
    - 4. Hat-Shaped, Rigid Furring Channels: 7/8 inch deep.
      - a. Minimum Base-Steel Thickness: 0.0329 inch .
    - 5. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
      - a. Configuration: Asymmetrical or hat shaped.
- 2.4 Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1. Armstrong World Industries, Inc.
    - 2. Chicago Metallic Corporation
    - 3. United States Gypsum Company.
- 2.5 AUXILIARY MATERIALS
- A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
  1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
  2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
  1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction

### 3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.
  1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C841 that apply to framing installation.
  2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C1063 that apply to framing installation.
  3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C844 that apply to framing installation.
  4. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### 3.4 INSTALLATION OF FRAMING SYSTEMS

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
  - 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated
  - 2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
  - 3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
  - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
  - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
  - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Shaped Furring Members:

1. Erect insulation, specified in Section 07 21 00 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

### 3.5 INSTALLATION OF SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 24 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
  - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
  - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards .
3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.

4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  5. Do not attach hangers to steel roof deck.
  6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

### 3.6 FIELD QUALITY CONTROL

- A. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

SECTION 092900  
GYPSUM BOARD ASSEMBLIES

PART 1      GENERAL

1.1      SUMMARY

- A.      Section includes metal stud wall framing; metal channel ceiling framing; sheet metal backing; gypsum board and joint treatment; gypsum sheathing; and acoustic insulation.
- B.      Related Sections:
  - 1.      Division 07 – Thermal Insulation.
  - 2.      Division 07 – Joint Sealants
  - 3.      Division 07 – Penetration Firestopping
  - 4.      Division 07 – Joint Firestopping

1.2      REFERENCES

- A.      ASTM C36 - Gypsum Wallboard.
- B.      ASTM C475 - Joint Compound and Joint Tape for Finishing Gypsum Board.
- C.      ASTM C645 - Non-Load Bearing (Axial) Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
- D.      ASTM C840 - Application and Finishing of Gypsum Board.
- E.      ASTM E119 - Test Methods for Fire Tests of Building Construction and Materials.
- F.      GA-216 (Gypsum Association) - Recommended Specifications for the Application and Finishing of Gypsum Board.
- G.      GA-600 (Gypsum Association) - Fire Resistance Design Manual.
- H.      UL (Underwriters Laboratories, Inc.) - Fire Resistance Directory.

1.3      SUBMITTALS

- A.      Shop Drawings: Indicate special details associated with fireproofing (if required), and acoustic seals.
- B.      Product Data: Submit data on metal framing, gypsum board, joint tape; acoustic accessories and all trim pieces.

#### 1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C840, ASTM C1280, GA-214, GA-216 and GA-600.

#### 1.5 QUALIFICATIONS

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

### PART 2 PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings in accordance with ASTM E119; tested by a qualified testing agency.

#### 2.2 GYPSUM BOARD ASSEMBLIES

- A. Manufacturers:
  - 1. National Gypsum Co.
  - 2. G-P Gypsum Corp.
  - 3. Celotex Building Products.
  - 4. United States Gypsum Co.
  - 5. No Substitutions.

#### 2.3 COMPONENTS

- A. Studs: ASTM C645; nominal 25-guage; 0.0179" minimum thickness of base metal for interior assemblies except 20-guage 0.0328" minimum thickness for reinforcement at door frames and ceramic wall tile assemblies.
- B. Depth of Section: As indicated on the drawings.
- C. Runners: Match studs; provide type recommended by stud manufacturer for floor and ceiling support of studs. Top track connection to structural steel frame shall be by deep leg tracks, metal angle clips or zee sections as required for spray-on fireproofing of steel members.
- D. Coating: All members shall be galvanized per ASTM A525 and ASTM A591.
- E. Furring, Framing, and Accessories: ASTM C645, GA-216 and GA-600.

- F. Fasteners: ASTM C514, ASTM C1002 and GA-216 as recommended by board manufacturer.
- G. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.
- H. Adhesive: ASTM C557, GA-216 and as recommended by board manufacturer
- I. Gypsum Board Materials:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - i. American Gypsum Co.
    - ii. G-P Gypsum.
    - iii. National Gypsum Company.
    - iv. USG Corporation.
  - 5. High Impact Gypsum Board: 5/8" High abuse GWB (floor to 8'-0" AFF) shall meet the following criteria:
    - a. ASTM D5420, Level 2 (minimum), surface indentation.
    - b. ASTM E695, Level 3 (minimum), soft body impact.
    - c. ASTM C1629, Level 2 (minimum), hard body impact.
    - d. Provide maximum available length in place; ends square cut, tapered edges.
  - 3. Standard Gypsum Board: ASTM C36; 5/8 inch thick, maximum available length in place; ends square cut, tapered edges. Use for above 8'-0" for closure to structure.
  - 4. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
    - a. Thickness: 1/2 inch.
    - b. Long Edges: Tapered.

## 2.4 ACCESSORIES

- A. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.

- B. Corner Beads: Metal. Corner beads are to be screwed (not crimped) to the metal studs.
- C. Edge Trim: GA-216; Type LC, L, LK, U exposed reveal bead. Shape as required.
- D. Joint Materials: ASTM C475; GA-201 and GA-216; reinforcing tape, joint compound, adhesive, and water.
- E. Fasteners: ASTM C1002, Type S12 and GA-216 as recommended by accessory manufacturer.
- F. Screws: ASTM C1002, with corrosion resistant treatment

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that site conditions are ready to receive work and opening dimensions are as instructed by the manufacturer.

### 3.2 INSTALLATION

#### A. Metal Stud Installation:

- 1. Install studs in accordance with ASTM C754, GA-216 and GA-600.
- 2. Metal Stud Spacing: 16 inches on center.
- 3. Extend stud framing to bottom of roof deck or structure. Attach ceiling runner securely to framing in accordance with details indicated. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.
- 4. Door Opening Framing: Install double studs at door frame jambs. Install stud tracks on each side of opening, at frame head height, and between studs and adjacent studs.

#### B. Sheet Metal Backing:

- 1. Sheet metal backing: Provide 6" x 16 gauge continuous in-wall sheet metal backing for support at all wall mounted equipment, accessories & fixtures, casework. Wood blocking is not permitted. Screw metal backing to studs.

#### B. Ceiling Framing Installation:

- 1. Install in accordance with ASTM C754.
- 2. Coordinate location of hangers with other work.

3. Install ceiling framing independent of walls, columns, and above ceiling work.
  4. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.
  5. Laterally brace entire suspension system.
- C. Acoustic Accessories Installation:
1. Install acoustic sealant within partitions.
- D. Gypsum Board Installation:
1. Install gypsum board in accordance with GA-216 and GA-600.
  2. Erect single layer gypsum board in most economical direction, with ends and edges occurring over firm bearing. Extend board 6 inches above ceiling or to roof deck, whichever is lower.
  3. Use screws when fastening gypsum board to metal furring or framing.
  4. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
  5. Gypsum Board Application and Finishing Standard: Install and finish gypsum board to comply with ASTM C840.
    - a. Install sound attenuation blankets continuous from floor to structure (where required) prior to gypsum board unless readily installed after board has been installed.
    - b. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 24 inches in alternate courses of board.
    - c. Install ceiling boards across framing in the manner which minimizes the number of end-butt joints, and which avoids end joints in the central area of each ceiling. Stagger end joints at least 24 inches.
    - d. Install wall/partition boards in manner which minimizes the number of end-butt joints or avoids them entirely where possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.
    - e. Do not install imperfect, damaged or damp boards.
    - f. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors and doors over 32 inches wide. Apply spot grout at each jamb anchor clip just before inserting board into frame.

- g. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide ¼ inch to ½ inch space and trim edge with “L” or “LC” edge trim. Seal joints with acoustical sealant.

E. Joint Treatment:

- 1. Finish in accordance with GA-214 Level (1) above ceilings only or (2 and 3) above ceilings only, (4) storage and utility areas, (5) all public, classroom, and office areas.
- 2. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
- 3. Feather coats on to adjoining surfaces so that camber is per finish level (i.e., 1/32 inch for level (4) and no camber for level (5)).
- 4. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile.

END OF SECTION

SECTION 093013  
CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Porcelain tile.
2. Ceramic mosaic tile.
3. Glazed wall tile.
4. Thresholds.
5. Tile backing panels.
6. Waterproof membranes.
7. Crack isolation membranes.
8. Setting material.
9. Grout materials.
10. Corner guards (for all areas)

1.2 DEFINITIONS

- A. General: Definitions in ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. Face Size: Actual tile size, excluding spacer lugs.
- C. Large Format Tile: Tile with at least one edge 15 inches or longer.
- D. Module Size: Actual tile size plus joint width indicated.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Porcelain tile.
2. Ceramic mosaic tile.
3. Glazed wall tile.
4. Thresholds.
5. Tile backing panels.
6. Waterproof membranes.
7. Crack isolation membranes.
8. Setting material.
9. Grout materials.

- B. Shop Drawings: Show locations, plans, and elevations, of each type of tile and tile pattern. Show widths, details, and locations of movement joints in tile substrates and finished tile surfaces.

- C. Samples for Initial Selection: For tile, grout, and accessories involving color selection or shade variation.
- D. Samples for Verification:
  - 1. Full-size units of each type and composition of tile and for each color and finish required.
  - 2. Full-size units of each type of trim and accessory.
  - 3. Stone thresholds in 6-inch lengths.
  - 4. Metal flooring transitions 6-inch lengths.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product, including product use classification.
- D. Product Test Reports:
  - 1. Tile-setting and -grouting products.
  - 2. Certified porcelain tile.
  - 3. Slip-resistance test reports from qualified independent testing agency.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Installer is a Trowel of Excellence member of the Tile Contractors' Association of America.
  - 2. Installer to submit five (5) projects completed within the last five years of similar size and scope with references and contact numbers of project managers and tile project superintendent.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

## 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in "Referenced Standards" Article in the Evaluations and manufacturer's written instructions.

# PART 2 - PRODUCTS

## 2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
  - 1. Provide tile complying with Standard Grade requirements.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
  - 1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

## 2.2 PORCELAIN TILE

### A. Porcelain Tile Type: [PT] Floor and Wall Tile.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crossville, Inc.
  - b. Daltile; a brand of Dal-Tile Corporation.
  - c. Florida Tile, Inc.
2. PT-1: Porcelain Tile: Provide flat tile complying with the following requirements.
  - a. Facial Dimensions (Wall Tile): 12" x 12"
  - b. Face: Plain with square edges
  - c. Style: **TBD**
  - d. Color(s): As selected by Architect from manufacturer's full range
  - e. Grout: As selected by Architect from manufacturer's full range
  - f. Design: As shown on finish elevation drawings
  - g. Location(s): Wall tile in Restroom. See finish plans & schedules.
3. PT-2: Porcelain Tile: Provide flat tile complying with the following requirements.
  - a. Facial Dimensions (Wall Tile): 6" x 6"
  - b. Face: Plain with square edges
  - c. Style: **TBD**
  - d. Color(s): As selected by Architect from manufacturer's full range
  - e. Grout: As selected by Architect from manufacturer's full range
  - f. Design: As shown on finish elevation drawings
  - g. Location(s): Accent wall tile in Restroom. See finish plans, schedules, and elevations.
4. PT-3: Porcelain Tile: Provide flat tile complying with the following requirements.
  - a. Facial Dimensions (Wall Tile): 12" x 12"
  - b. Face: Plain with square edges
  - c. Style: **TBD**
  - d. Color(s): As selected by Architect from manufacturer's full range
  - e. Grout: As selected by Architect from manufacturer's full range
  - f. Design: As shown on finish elevation drawings
  - g. Location(s): Accent wall tile in Restroom. See finish plans, schedules, and elevations.
5. PT-4: Porcelain Tile: Provide flat tile complying with the following requirements.
  - a. Facial Dimensions (Floor Tile): 12" x 12"
  - b. Face: Plain with square edges
  - c. Style: **TBD**
  - d. Color(s): As selected by Architect from manufacturer's full range
  - e. Grout: As selected by Architect from manufacturer's full range
  - f. Design: Stacked
  - g. Location(s): Restroom

## 2.3 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
  - 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.
- B. Granite Thresholds: ASTM C615/C615M, with honed finish.
  - 1. Description:
    - a. Granite type (color TBD), honed finish, door frame width x 1/2" size by full width of wall or frame opening, beveled both sides, radiused edges from bevel to vertical face. Meet ADA requirements for maximum threshold heights. Use where thresholds are required in resinous flooring and at all transitions at doors in tile flooring. If different types of tile abut one another and no door is present, then a threshold is to be provided.

## 2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges in maximum lengths available to minimize end-to-end butt joints.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. C-Cure.
    - b. Custom Building Products.
    - c. USG Corporation.
  - 2. Thickness: 1/2 inch .
  - 3. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

## 2.5 WATERPROOF MEMBRANES

- A. General: Manufacturer's standard product that complies with ANSI A118.10 and ANSI A118.12 and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Waterproof Membrane, Fluid Applied: Liquid-latex rubber or elastomeric polymer with continuous fabric reinforcement.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Custom Building Products.
    - b. Laticrete International, Inc.
    - c. MAPEI Corporation.

2. Locations: For Thin-set Tile Installations (at all locations recommended in the TCNA Handbook including but not limited to large format tiles, tile landings and showers)

## 2.6 CRACK ISOLATION MEMBRANES

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Locations: For Thin-set Tile Installations (at all locations recommended in the TCNA Handbook including but not limited to large format tiles, tile landings and showers)

## 2.7 SETTING MATERIALS

- A. Mortar Materials:
  1. Standard Dry-Set Mortar (Thinset): ANSI A118.1.
  2. 1:1: Portland cement-hydrated lime-sand mix, in accordance with manufacturer's instructions.
  3. Mapei Ultraflex LFT: Large Format Porcelain Tile
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Custom Building Products.
  - b. Laticrete International, Inc.
  - c. MAPEI Corporation.
- C. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.1.

## 2.8 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.
- B. Standard Cement Grout: ANSI A118.6.
  1. Sand-Portland Cement as Dry-Set type
- C. Water-Cleanable Epoxy Grout: ANSI A118.3.
  1. Two-component 100%-solids waterproof epoxy grout. Non-sagging and non-slumping, non-yellowing, water cleanable as recommended by TNCA for installation. All porcelain tile to receive epoxy grout. Use Mapei Kerapoxy CQ at all porcelain tile.
    - a. Color: As selected by Architect from manufacturer's full range

2. Locations: Group toilets, showers, janitor's room, serving/kitchen areas, single toilet restrooms, etc.

## 2.9 MISCELLANEOUS MATERIALS

### A. Trim Units

1. Provide Satin Anodized Clear Aluminum trim units @ porcelain tile and Satin Stainless Steel @ Ceramic Tile
2. Size: To accommodate tile sizes and thicknesses specified
3. Shapes: As follows, selected from manufacturer's standard shapes:
  - a. External Corners: Radius Corner Trim, Clear Satin Anodized Aluminum Corner Guards—full height of wall tile
  - b. Internal Corners: Field-butt square corners.
  - c. Provide Satin Anodized Clear Aluminum trim units- Shape to be selected from manufacturer's full range

- B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

- C. Grout Sealer: Grout manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
  2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
  3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove coatings, including curing compounds or other coatings, that are incompatible with tile-setting materials.

- B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- C. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1 and is sloped 1/4 inch per foot toward drains.
- D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- E. Substrate Flatness:
  - 1. For tile shorter than 15 inches, confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. from the required plane, and no more than 1/16 inch in 12 inches when measured from tile surface high points.
  - 2. For large format tile, tile with at least one edge 15 inches or longer, confirm that structure or substrate is limited to 1/8 inch in 10 ft. from the required plane, and no more than 1/16 inch in 24 inches when measured from tile surface high points.

### 3.3 INSTALLATION. GENERAL

- A. Install tile backing panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.
- B. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
  - 1. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.
- C. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
  - 1. Allow crack isolation membrane to cure before installing tile or setting materials over it.
- D. Mix mortars and grouts to comply with "Referenced Standards" Article in the Evaluations and mortar and grout manufacturers' written instructions.
  - 1. Add materials, water, and additives in accurate proportions.
  - 2. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

- E. Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series that are referenced in TCNA installation methods and specified in tile installation schedules and apply to types of setting and grouting materials used.
1. For the following installations, follow procedures in ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
    - a. Tile floors in wet areas.
    - b. Tile floors consisting of tiles 8 by 8 inches or larger.
  2. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
  3. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
  4. Provide manufacturer's standard trim shapes, satin stainless steel or satin anodized aluminum trim pieces as indicated on drawings where necessary to eliminate exposed tile edges.
  5. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
  6. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
    - a. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets, so joints between sheets are not apparent in finished Work.
    - b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
    - c. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
  7. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- F. Movement Joints: Provide movement joints and other sealant-filled joints, including control, contraction, and isolation joints, where required. Form joints during installation of setting materials, mortar beds, and tile. Keep joints free of dirt, debris, and setting materials prior to filling with sealants. Do not saw-cut joints after installing tiles.
1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- G. Thresholds: Install stone and solid surface thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

- H. Metal Flooring Transitions: Install at locations where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.
- I. Grout Sealer: Apply grout sealer to grout joints in accordance with manufacturer's written instructions. As soon as sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

### 3.4 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.
- D. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

END OF SECTION

SECTION 095113  
ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes acoustical panels systems for ceilings.

1.3 DEFINITIONS

- A. CAC: Ceiling Attenuation Class.
- B. LR: Light Reflectance coefficient.
- C. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Ceiling suspension system members.
  - 2. Method of attaching hangers to building structure.
  - 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers access panels, and special moldings.
  - 4. Minimum Drawing Scale: 1/8 inch = 1 foot.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on samples of size indicated below.
  - 1. Acoustical Panel: Set of 6-inch square samples of each type, color, pattern, and texture.
  - 2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch long samples for each type, finish and color.
- D. Qualification Data: For testing agency.
- E. Field quality-control test reports.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.

- G. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor and fastener type.
- H. Maintenance Data: For finishes to include in maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
- B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

#### 1.6 DELIVERY STORAGE AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panels ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for project when occupied for its intended use.

#### 1.8 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

#### 1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.
3. Hold-Down Clips: Equal to 2.0 percent of quantity installed.

## PART 2 PRODUCTS

### 2.1 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designed by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
  1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E795.
- B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
  1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

### 2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING (ACP)

- A. Products: Subject to compliance with requirements, provide one of the following:
  1. Armstrong World Industries, Inc.; "Designer" 737, course texture, angled tegular edge, to be used as standard of quality & finish.
  2. Chicago Metallic Corporation
  3. Tectum, Inc.
  4. USG Interiors, Inc.
- B. Classification: Provide panels complying with ASTM E 1264 for type, form and pattern as follows:
  1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
  2. Pattern: CE (perforated, small holes and lightly textured).
  3. Fire Class A; Flame Spread Index of 25 or less. Smoke Developed Index of 50 or less (UL labeled). Ceiling tiles shall be listed for plenum conditions ; tested per ASTM E-84.
- C. Color: White.
- D. LR: Not less than 0.81.
- E. NRC: Not less than 0.55.

- F. CAC: Not less than 33.
- G. Edge/Joint Detail: Tegular edge.
- H. Thickness: 5/8 inch.
- I. Modular Size: 24 by 24 inches (ACP)
- J. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.

## 2.3 METAL SUSPENSION SYSTEMS, GENERAL

- A. Hang ceiling at height indicated on drawings.
- B. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
- C. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
  - 1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
- D. Attachment Devices: Size for five times the design load indicated in ASTM C635, Table 1, "Direct Hung", unless otherwise indicated. Comply with seismic design requirements.
  - 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
    - a. Type: Post-installed expansion anchors.
    - b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
    - c. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
    - d. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
- E. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch diameter wire.
- F. Hold-Down Clips: Where indicated and at all Vestibules and at Kitchen areas, provide manufacturer's standard hold-down clips spaced 24 inches on center on all cross tees.

## 2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

- A. Products: Subject to compliance with requirements, provide one of the following:
1. Armstrong World Industries, Inc.; "Prelude" 15/16" exposed T grid (white) to be used as standard of quality.
  2. BPB USA
  3. Chicago Metallic Corporation
  4. Ecophon CertainTeed, Inc.
  5. USG Interiors, Inc.
- B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation, with prefinished 15/16 inch wide or 9/16 inch (dependent on type) metal caps on flanges.
1. Structural Classification: Intermediate-duty system.
  2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
  3. Face Design: Flat, flush.
  4. Cap Material: Steel cold-rolled sheet.
  5. Cap Finish: Painted white and to match color of acoustical unit.

## 2.5 ACOUSTICAL SEALANT

- A. Products: Subject to compliance with requirements, provide one of the following:
1. Acoustical Sealant for Concealed Joints:
    - a. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
    - b. Pecora Corporation; BA-98.
    - c. Tremco, Inc.; Tremco Acoustical Sealant.
- B. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying; nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling

installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

### 3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook".
- B. Suspend ceiling hangers from building's structural members and as follows:
  1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
  3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
  4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  7. Do not attach hangers to steel deck tabs.
  8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
  10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
  - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  - 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
  - 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
  - 1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
  - 2. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
  - 3. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension systems surfaces and panel faces flush with bottom face of runners.
  - 4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
  - 5. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

### 3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 096513  
RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Resilient base.
  - 2. Resilient molding accessories.
- B. Related Sections:
  - 1. Division 09 Section "Resilient Floor Tile"

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.
- C. Product Schedule: For resilient and aluminum products.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class II, not less than 0.22 W/sq. cm.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

## 1.6 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

## 1.7 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

## PART 2 - PRODUCTS

### 2.1 RESILIENT BASE

- A. Resilient Base:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Tarkett
    - b. Armstrong World Industries, Inc.
    - c. Roppe
- B. Resilient Base Standard: ASTM F 1861.
  - 1. Material Requirement: Type TV (Thermoplastic Vinyl) or Type TP (rubber, thermoplastic).
  - 2. Manufacturing Method: Group I (solid, homogeneous).
  - 3. Style: Cove (base with toe) unless noted otherwise.
- C. Minimum Thickness: 0.125 inch.
- D. Height: 4 inches.
- E. Lengths: Coils in manufacturer's standard length (coils no less than 100').
- F. Corners: Base is to run continuous at all walls and outside corners. Spices and miters allowed at inside corners only.

- G. Finish: As selected by Architect & Owner from manufacturer's full range.
- H. Colors and Patterns: As selected by Architect & Owner from full range of industry colors.

## 2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are same temperature as the space where they are to be installed.
  - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

### 3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.

- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners:
  - 1. Inside Corners: Use straight pieces of maximum lengths possible.

### 3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

### 3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products until Substantial Completion.

END OF SECTION

SECTION 096519  
RESILIENT FLOOR TILE (LVT)

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. High Performance Luxury Vinyl Flooring (LVT)
- B. Related Sections:
  - 1. Division 9 Section "Resilient Wall Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
  - 1. Show details of special patterns.
  - 2. Provide shop drawings with each color number clearly designated.  
Contractor is not released to begin installation until shop drawings have been reviewed and approved.
- C. Samples for Verification: Full-size units of each color and pattern of floor tile required.
- D. Product Schedule: For floor tile. Use same designations indicated on Drawings.
- E. Qualification Data: For qualified installer.
- F. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation indicated.
- B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class II, not less than 0.22 W/sq. cm.

## 1.5 DELIVERY STORAGE AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

## 1.6 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. Before installing LVT over a new or existing concrete subfloor, test the moisture and alkalinity levels of the concrete. All concrete substrates should be tested for moisture by use of the in Situ Probe RH test method (ASTM F 2170) and pH following ASTM F 710 guidelines.
- C. Unit Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

## 1.7 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Floor Tile (LVT): Furnish 1 box each of each type, color, pattern of floor tile installed.

## PART 2 PRODUCTS

### 2.1 HIGH PERFORMANCE LUXURY VINYL TILE [LVT-1], [LVT-2], & [LVT-3]

- A. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Tarkett
  - 2. Armstrong World Industries, Inc
  - 3. Tandus Centiva
  - 4. Mannington Mills, Inc.

B. Tarkett (as basis of design)

1. Colors and Patterns: As selected by Architect and Owner from full range of industry colors including premium.
2. Style: **TBD**
3. Tile Size: **TBD**
4. Wear Layer Thickness: 32 mil
5. Total Thickness: 4 mm
6. Product Construction: High Performance Luxury Vinyl Tile
7. Class/ ASTM F1700: Class III, Type B
8. Backing Class: Commercial Grade
9. Finish: **TBD**
- 10: Installation Method: Glue-Down

ASTM E 648	Fire Resistance	Class 1
ASTM D 2047	Coefficient of Friction	SCOF $\geq$ 0.5
ASTM F 970	Static Load	250 PSI
ASTM F 925	Chemical Resistance	Pass
ASTM F1914	Residual Indentation	Pass
ASTM F 386	Overall Thickness	4.0 mm

## 2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant Type recommended by manufacturer.
- C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer. Follow manufacturer's recommendations.

## PART 2 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curling compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
  - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
  - 4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
    - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq.ft. in 24 hours.
    - b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.
  - 5. For installation over concrete with up to 85% relative humidity (RH) and pH up to 9.0, install with adhesive as recommended by manufacturer. Standard installation instructions apply. For installation over concrete with up to 95% RH and pH up to 11.0, install with the recommended adhesive in conjunction with moisture vapor reduction system. All written requirements for product application, including, but not limited to, moisture and pH testing protocols, must be met or the LVT products will not be covered by warranty. When moisture and/or pH conditions exceed these stated limits, STOP and contact manufacturer.

- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are same temperature as space where they are to be installed.
  - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.
- F. The permanent HVAC system must be on and maintained at a minimum of 68° F (20°C).
- G. Conduct an adhesive bond test.

### 3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, working from middle of space to edges per layout and pattern that will be provided, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
- D. Scribe, cut and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets and door frames.
- E. Extend floor tiles into to spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, non-staining marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising

and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

- I. LVT: Follow manufacturer's instructions for installation conditions and requirements.

### 3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.
- C. Apply sealant or polish as recommended by manufacturer.
- D. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- E. Cover floor tile until Substantial Completion.

END OF SECTION

SECTION 096813  
TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Modular carpet tile.
- B. Related Requirements:
  - 1. Section 096513 "Resilient Base and Accessories" and Section 096519 "Resilient Tile Flooring" for resilient wall base and accessories installed with carpet tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
  - 2. Include manufacturer's written installation recommendations for each type of substrate.
- B. Shop Drawings: For carpet tile installation, plans showing the following:
  - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
  - 2. Carpet tile type, color, and dye lot.
  - 3. Type of subfloor.
  - 4. Type of installation.
  - 5. Pattern of installation.
  - 6. Pattern type, location, and direction.
  - 7. Pile direction.
  - 8. Type, color, and location of insets and borders.
  - 9. Type, color, and location of edge, transition, and other accessory strips.
  - 10. Transition details to other flooring materials.
- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
  2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long Samples.
- D. Product Schedule: For carpet tile. Use same room and product designations indicated on Drawings and in schedules.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
  1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
  2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
- B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Product Options: Products and manufacturers named in Part 2 establish requirements for product quality in terms of appearance, construction, and performance. Other

manufacturers' products comparable in quality to named products and complying with requirements may be considered. Refer to Division 1 Section "Substitutions."

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Carpet and Rug Institute's CRI 104.

#### 1.9 FIELD CONDITIONS

- A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

#### 1.10 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Carpet Tile Warranty: Written warranty, signed by carpet tile manufacturer agreeing to replace carpet tile that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.
  - 1. Warranty Period: **10** years from date of Substantial Completion.
  - 2. Limited Commercial Lifetime Warranty

### PART 2 - PRODUCTS

#### 2.1 CARPET TILE **[CPT-1]**

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include the following:
  - 1. Mannington (Design Standard)
  - 2. Bentley
  - 3. Mohawk Group
    - a. Style Names: Moso

- b. Product Size: 24" x 24" tiles
  - c. Primary Backing: Manufactures recommended.
  - d. Fiber Content: Antron 6.6 Fiber
  - e. Pile Thickness: 0.137 inches
  - f. Pile Density: 5,781 oz./cu. yd.
  - g. Pattern may be laid: Horizontal Brick Ashlar
  - h. Color: Selected by the Owner from manufacturer's full range
4. Alternate Manufacturers are subject to prior approval. Proposed Equals must be similar in aesthetic intent as well as performance components.

## 2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that concrete slabs comply with ASTM F 710 and the following:
  - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
  - 2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet tile.
  - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

### 3.3 INSTALLATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet tile manufacturer.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders.

### 3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
  - 1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
  - 2. Remove yarns that protrude from carpet tile surface.
  - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.

- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

SECTION 097200  
WALL COVERINGS (CUSTOM DIGITAL)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Vinyl Wall Covering.
- B. Related Sections include the following:
  - 1. Division 09 Section "Interior Painting" for priming wall surfaces.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.
- B. Samples for Verification: Full width by 36-inch- long section of wall covering from lot to be used for each type of wall covering indicated for each color, texture, and pattern required.
  - 1. Show complete pattern repeat.
  - 2. Mark top and face of material.
- C. Maintenance Data: For wall coverings to include in maintenance manuals.
- D. QUALITY ASSURANCE Fire-Test-Response Characteristics: Provide wall coverings and adhesives with the following fire-test-response characteristics as determined by testing identical products applied with identical adhesives to substrates per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Surface-Burning Characteristics: As follows, per ASTM E 84:
    - a. Flame-Spread Index: 25 or less.
    - b. Smoke-Developed Index: 450 or less.

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install wall coverings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

- B. Lighting: Do not install wall covering until a permanent level of lighting is provided on the surfaces to receive wall covering.
- C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

## 1.5 EXTRA MATERIALS

- A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Wall-Covering UV Film Protectant: Full-size units equal to 5 percent of amount of each type installed.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. National Solutions: <https://www.nationalsolutions.com/>
- B. Momentum Textiles & Wallcovering: <https://momentumtextilesandwalls.com/>
- C. Koroseal: <https://koroseal.com/>

### 2.2 WALL-COVERING PRODUCTS

- A. General:
- B. Vinyl Wall Covering, **[VWC-1] & [VWC-2]**- (See Drawings for Locations)
  - 1. Products:
- C. General: Provide rolls of each type of wall covering from the same run number or dye lot.
- D. Vinyl Wall Covering
  - 1. Pattern: Custom Images
  - 2. Width: 53/55" wide.
  - 3. Total Weight: 20 ounces per linear yard.
  - 4. Backing: Polyester Nonwoven
  - 5. Flammability: ASTM E-84 Class A.
  - 6. Colors, Textures, and Patterns: Custom Image Graphic provided by Architect
  - 7. Stain/ Soil Resistant Coating: Instacure Guardian ICUV-GM (Matte): UV Curable Coating with Flame Retardant and Microbial Suppression in Non-Metallic Based Formula. Satin Matte Finish. See [www.advfinishing.com](http://www.advfinishing.com) for additional information.

## 2.3 ACCESSORIES

- A. Adhesive: Mildew-resistant, non-staining, strippable adhesive, for use with specific wall covering and substrate application, as recommended in writing by wall-covering manufacturer.
- B. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Division 09 Section "Interior Painting "and recommended in writing by wall-covering manufacturer for intended substrate.
- C. Wall Liner: Nonwoven, synthetic underlayment and adhesive as recommended by wall-covering manufacturer.
- D. Seam Tape: As recommended in writing by wall-covering manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair wall covering's bond, including mold, mildew, oil, grease, incompatible primers, dirt, and dust.
- C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
  - 1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
  - 2. Gypsum Board: Prime with primer recommended by wall-covering manufacturer.
  - 3. Painted Surfaces: Treat areas susceptible to pigment bleeding.
- D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finishes with fine sandpaper.
- E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
- F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

- G. Install wall liner, with no gaps or overlaps, where required by wall-covering manufacturer. Form smooth wrinkle-free surface for finished installation. Do not begin wall-covering installation until wall liner has dried.

### 3.3 INSTALLATION

- A. General: Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Cut wall-covering strips in roll number sequence. Change roll numbers at partition breaks and corners.
- C. Install strips in same order as cut from roll.
- D. Install reversing every other strip.
- E. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.
- F. Match pattern 72 inches above the finish floor.
- G. Install seams vertical and plumb at least 6 inches from outside corners and 6 inches from inside corners unless a change of pattern or color exists at corner. No horizontal seams are permitted.
- H. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.
- I. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.

### 3.4 CLEANING

- A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.
- B. Use cleaning methods recommended in writing by wall-covering manufacturer.
- C. Replace strips that cannot be cleaned.
- D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION

SECTION 098410  
ACOUSTICAL WALL TREATMENT

PART 1      GENERAL

1.1      SUMMARY

- A.      Section Includes: Custom fabricated acoustical wall panels.

1.2      REFERENCES

- A.      ASTM International:
1.      ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3      SYSTEM DESCRIPTION

- A.      Performance Requirements:
1.      Surface Burning Characteristics (ASTM E84-17a, Class A):
    - a.      Flamespread: 25, maximum.
    - b.      Smoke Developed: 450, maximum.
    - c.      Class A Fire Rated
  2.      Indoor Air Quality: Low VOCs emissions, formaldehyde and Phenol-free
  3.      Light Fastness: ISO 105-B02 1994, 6-7
  4.      Interior wall and ceiling finish materials shall be classified in accordance with NFPA 286.
    - a.      During the 40 kW exposure, flames shall not spread to the ceiling.
    - b.      The flames shall not spread to the outer extremity of the sample on any wall or ceiling.
    - c.      Flashover, as defined in NFPA 286, shall not occur.
    - d.      The peak heat release rate throughout the test shall not exceed 800 kW.
    - e.      The total smoke released throughout the test shall not exceed 1,000 m<sup>2</sup>.

1.4      SUBMITTALS

- A.      General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.
- B.      Product Data: Submit product data sheet, for specified products.
- C.      Shop Drawings: Submit shop drawings showing layout, edge profiles and panel components, including anchorage, accessories, finish colors and textures.
- D.      Samples: Submit selection and verification samples of finishes, colors and textures.

- E. Test Reports: Certified test reports showing compliance with specified performance requirements.
  - 1. Standard Systems: Submit certified copies of previous test reports substantiating performance of system in lieu of retesting.

## 1.5 QUALITY ASSURANCE

- A. Regulatory Requirements and Approvals

## 1.6 DELIVERY, STORAGE & HANDLING

- A. General: Comply with Division 1 Product Requirements Section.
- B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

## 1.7 PROJECT CONDITIONS

- A. Environmental Requirements: Do not install panels until wet work, such as concrete and plastering, is complete; the building is enclosed; and the temperature and relative humidity are stabilized at 60 - 80 degrees F (16 - 27 degrees C) and 45%, respectively.

# PART 2 PRODUCTS

## 2.1 ACOUSTICAL WALL PANELS

- A. Manufacturers; PET Acoustical Felt Carved Surface Panel Tiles
  - 1. CSI Creative; <https://www.csicreative.com/>
  - 2. FilzFelt; <https://www.filzfelt.com/>
  - 3. Unika Vaev; <https://unikavaev.com/>,
  - 4. Acoufelt; <https://www.acoufelt.com/>

## 2.2 MANUFACTURED UNITS

- A. Acoustical Felt Carved Panel: **[WP-1] & [WP-2]**
  - 1. Thickness: ½-inch
  - 2. Material: Recycled PET Acoustical Felt
  - 3. Size: 48 inches x 108 inches
  - 4. Layout: See interior elevations
  - 5. Color: Up to two (2) colors; Select from manufacturer's full range
  - 6. Mounting Accessories: Construction Adhesive

## 2.3 INSTALLATION

- A. General: Install per manufacturer's written instructions.
- B. Allow acoustic panels to acclimate for a minimum of 24 hours prior to installation.
- C. Do not install panels until building HVAC is fully operational.
- D. Ensure that wall substrate is clean and free of dust, holes, or damage prior to panel installation.
- E. Utilize construction adhesive as recommended by the manufacturer.

END OF SECTION

SECTION 099000  
PAINTING

PART 1        GENERAL

1.1       SUMMARY

- A.       Section includes surface preparation and field application of paints, stains, varnishes, and other coatings.
- B.       Work includes, but is not limited to:
  - 1.       Painting and finishing of interior items and surfaces including surface preparation and priming. Surface preparation, priming, and finish coats specified in this section are in addition to shop priming and surface treatment specified under other sections.
  - 2.       "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
  - 3.       Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, Owner will select these from standard colors or finishes available.
  - 4.       Paint exposed surfaces whether or not colors are designated in schedules, except where a surface or material is specifically indicated not to be painted or to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Owner will select from standard colors or finishes available.
  - 5.       All existing painted items/ rooms to receive new paint in this project.

1.2       REFERENCES

- A.       ASTM D16 - Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
- B.       ASTM D823-95 Standard Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products.
- C.       ASTM D5150-92 (1997) e1 Standard Test Method for Hiding Power of Architectural Paints Applied by Roller.
- D.       ASTM D3276-96 Standard Guide for Painting Inspectors- (metal substrates).

1.3       DEFINITIONS

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

#### 1.4 SUBMITTALS

- A. Product Data: Submit data on all finishing products. Submit manufacturer's technical information including paint label analysis and application instructions for each material proposed for use.
- B. Samples: Provide a listing of material and application for each coat of each finish sample. Submit samples for Architect's review of color and texture only. Submit two paper chip samples, illustrating range of colors and textures available for each surface finishing product scheduled.

#### 1.5 CLOSEOUT SUBMITTALS

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

#### 1.6 QUALIFICATIONS

- A. Applicator: Company specializing in performing the work of this section with minimum five years documented experience.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

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

#### 1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Do not apply exterior coatings during rain, fog, mist, or snow when relative humidity is outside the humidity ranges, or moisture content of surfaces exceed those required by the paint product manufacturer.
- C. Minimum Application Temperature for Varnish: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
- D. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 degrees F.

- E. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

## PART 2 PRODUCTS

### 2.1 PAINTS AND COATINGS

- A. Provide materials as manufactured by Sherwin-Williams, PPG, Duron, Tnemec, or Benjamin Moore.
- B. The quality of paint shall be equal to Sherwin Williams or Tnemec product numbers as specified in the schedule below.
- C. AE and Owner shall select paint colors.

### 2.2 SCHEDULE

- A. Interior Drywall (Walls):
  - 1. Prime Coat (New Walls): SW B28W08000 - PVA Drywall Primer & Sealer
  - 2. Prime Coat (Existing Walls): SW B28W08000 - PVA Drywall Primer & Sealer
  - 3. Intermediate Coat: SW B20W12651 - ProMar® 200 Zero VOC Interior Latex Eg-Shel
  - 4. Top Coat: SW B20W12651 - ProMar® 200 Zero VOC Interior Latex Eg-Shel
- B. Interior Drywall (Ceilings and Soffits):
  - 1. Prime Coat: SW B28W08000 - PVA Drywall Primer & Sealer
  - 2. Intermediate Coat: SW B20W12651 - ProMar® 200 Zero VOC Interior Latex Eg-Shel
  - 3. Top Coat: SW B20W12651 - ProMar® 200 Zero VOC Interior Latex Eg-Shel
- C. Interior Concrete Masonry:
  - 1. First Coat: Series: 130 Envirofill high performance block filler.
  - 2. Second Coat: SW-DTM Acrylic semi gloss, B66W200 Series
  - 3. Third Coat: SW-DTM Acrylic semi gloss, B66W200 series
- D. Hollow Metal Doors and Frames
  - 1. System Type: High Performance Finish- Semi-Gloss

2. Prime Coat: SW B66W00011 - PRO INDUSTRIAL DTM ACR PRIMER/FINISH Series (Use manufacturer's recommendation at existing doors and Frames).
3. Intermediate Coat: SW B66W01151 - Pro Industrial DTM Acrylic Semi-Gloss
4. Top Coat: SW B66W01151 - Pro Industrial DTM Acrylic Semi-Gloss

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Applicator must examine areas and conditions under which painting work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator. Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.
- B. Test shop applied primer for compatibility with subsequent cover materials.
- C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below 8%.

### 3.2 PREPARATION

- A. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- B. Surfaces: Correct defects and clean surfaces that affect work of this section. Remove or repair existing coatings that exhibit surface defects.
- C. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- E. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- F. Metal Doors Scheduled for Painting: All hollow metal frames shall receive one field prime coat, front and back, before erection (color to be medium gray); after erection, touch-up all abrasive marks; this prime coat is in addition to factory prime coat and to the two coats of finish painting specified under Paragraph 2.2. Protect from dust while drying.

- G. Apply a bead of sealant where hollow metal door frames abut adjacent wall surfaces.

### 3.3 APPLICATION

- A. Spray painting will be permitted wherever practical; however, excess thinning will not be permitted and complete surface coverage shall be equal to that of first class brush work. Do not spray paint concrete block unless it is immediately back-rolled.
- B. Do all touch-up and clean-up at the completion of this work to leave all surfaces in a finished condition.
- C. Visible surfaces on interior of ducts behind louvers, diffusers, registers and grilles shall be primed and then painted with one coat of flat black metal enamel.
- D. Belt guards and other protective guards on equipment shall be painted with two coats of safety yellow metal enamel.
- E. Insulated pipes and ducts with paper or canvas jacket shall be painted with one coat of paint equal to Sherwin Williams SW-Preprite 200 Latex Wall Primary, and insulated surfaces with aluminum foil jacket shall be painted with one coat of Zinc Chromate Primer prior to two coats of finish paint. Armaflex type insulation on exposed pipes shall be painted with two coats of latex base paint equal to SW-PROMAR 200 Latex flat wall paint tinted to match background color.
- F. Mechanical equipment surfaces with asphalt or bitumen coating shall be sealed with an approved asphalt sealer and painted with two coats of SW-KemKromik universal/metal primer, B5ONZ6.
- G. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- H. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.
- I. Sand wood and metal surfaces lightly between coats to achieve required finish.
- J. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior applying next coat.
- K. Protect work of other trades, whether being coated or not, against damage from coating.

### 3.4 CLEANING

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

END OF SECTION

SECTION 101100  
VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Markerboards.
  - 2. Horizontal Sliding Marker Wall Systems.

1.3 DEFINITIONS

- A. Visual Display Boards: Markerboards.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Show location of panel joints.
  - 2. Include sections of typical trim members.
- C. Samples for Verification: For each type of visual display surface indicated and as follows:
  - 1. Visual Display Surface: Not less than 8-1/2 by 11 inches, mounted on substrate indicated for final Work. Include one panel for each type, color, and texture required.
  - 2. Trim: 6-inch- long sections of each trim profile.
  - 3. Accessories: Full-size Sample of each type of accessory.
- D. Maintenance Data: For visual display surfaces to include in maintenance manuals.
- E. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of visual display surface through one source from a single manufacturer.

- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of visual display surfaces and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-built visual display boards, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.
- B. Store visual display units vertically with packing materials between each unit.

## 1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.
  - 1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

## 1.8 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Surfaces lose original writing and erasing qualities.
    - b. Surfaces become slick or shiny.
    - c. Surfaces exhibit crazing, cracking, or flaking.
  - 2. Warranty Period: 50 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Product: Subject to compliance with requirements, provide product specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 MATERIALS, GENERAL

- A. Porcelain-Enamel Face Sheet: Manufacturer's standard steel sheet with porcelain-enamel coating fused to steel; uncoated thickness indicated.
  - 1. Gloss Finish: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser.
- B. Particleboard: ANSI A208.1, Grade 1-M-1.
- C. Fiberboard: ANSI A208.2, Grade MD.
- D. Extruded Aluminum: ASTM B 221, Alloy 6063.

## 2.3 MARKERBOARD ASSEMBLIES

- A. Porcelain-Enamel Markerboard Assembly: Balanced, high-pressure, factory-laminated markerboard assembly of 3-ply construction consisting of backing sheet, core material, and 0.13 inch thick porcelain-enamel face sheet with low gloss finish.
  - 1. Manufacturers:
    - a. Claridge Products & Equipment, Inc.; Series 800, LCS Deluxe - LCS3 Porcelain Dry Erase Whiteboard with marker tray is basis of design for instruction. Frame finish is to be natural aluminum. Basis of design for horizontal sliding marker wall system is Claridge LCS Porcelain Sliding Wall with bottom mount.
    - b. Best-Rite Manufacturing.
    - c. Marsh Industries, Inc.
  - 2. Particleboard Core: 1/2 inch thick; with 0.015-inch- thick, aluminum sheet backing.
  - 3. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard moisture-barrier backing.
  - 4. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.
  - 5. Marker surface to be metal for use with magnets.

## 2.4 MARKERBOARD ACCESSORIES

- A. Provide manufactures concealed hanging clips for mechanical fastening. No adhesives are permitted.
- B. Marker tray: Manufacturer's standard, continuous. Mount tray at 34" AFF.
  - 1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.
- C. Map Rail: Provide the following accessories:
  - 1. Display Rail: On series 800 provide continuous and integral with map rail; fabricated from linoleum approximately 1 to 2 inches wide.
  - 2. End Stops: Located at each end of map rail.
  - 3. Hangars – provide 4 map rail hangars.

## 2.5 FABRICATION

- A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.
- B. Visual Display Boards: Factory assemble visual display boards, unless otherwise indicated.
  - 1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.
- C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
  - 1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect and as indicated on approved Shop Drawings.
  - 2. Provide manufacturer's standard vertical-joint spline system between abutting sections of markerboards.
  - 3. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.
- D. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to neat, hairline closure.
  - 1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

## 2.6 ALUMINUM FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- D. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance.
  - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
- B. Examine walls and partitions for proper backing for visual display surfaces.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove dirt, scaling paint, projections, and depressions that will affect smooth, finished surfaces of visual display boards.
- B. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, and substances that will impair bond between visual display boards and surfaces.

### 3.3 INSTALLATION, GENERAL

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated mount marker tray surface 34" above finish floor. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- B. Provide Acoustically Separated Mounting Clips at Markerboard locations.
- C. All markerboards shall be mechanically fastened using manufactures concealed clips. No adhesives are permitted.

### 3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY UNITS

- A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls.

### 3.5 CLEANING AND PROTECTION

- A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.

- C. Cover and protect visual display surfaces after installation and cleaning.

### 3.6 VISUAL DISPLAY SURFACE SCHEDULE

#### A. Markerboards: Factory assembled.

1. Markerboard: Porcelain-enamel on steel markerboard assembly, LCS3 (MB).
  - a. Color: Claridge, 100 White.
2. Factory -Applied Aluminum Trim: Manufacturer's standard with clear anodic finish for series 800.
3. Accessories:
  - a. Map rail with display rail, end stops for series 800.
4. Width: As indicated on Drawings.
5. Height: As indicated on the Drawings.
6. Mounting: Wall – series 800.

#### B. Horizontal Sliding Marker Wall Systems:

1. Horizontal Porcelain Sliding Wall: Porcelain-enamel on steel markerboard assembly, LCS.
  - a. Color: Claridge, 100 White.
2. Factory -Applied Aluminum Trim: Manufacturer's standard with clear anodic finish.
3. Size: as indicated on the drawings.
4. 3 tracks
5. 2 sliding panels per track (1 per each side)
6. Accessories:
  - a. Stainless steel bottom track.
  - b. Track stop at center of wall bump out (see floor plans).

END OF SECTION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Public-use washroom accessories.

### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
  - 1. Construction details and dimensions.
  - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
  - 3. Material and finish descriptions.
  - 4. Features that will be included for Project.
  - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
  - 1. Identify locations using room designations indicated on Drawings.
  - 2. Identify products using designations indicated on Drawings.
- C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

### 1.4 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch minimum nominal thickness.
- C. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- D. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

### 2.2 ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. A & J Washroom Accessories, Inc.
  - 2. American Specialties, Inc.
  - 3. Bobrick Washroom Equipment, Inc.
  - 4. Bradley Corporation.
- B. Grab Bar **[GB1, GB2, GB3]**:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ASI-American Specialties, Inc.
    - b. Bobrick Washroom Equipment, Inc.
    - c. Bradley Corporation.
  - 2. Mounting: Flanges with concealed fasteners.
  - 3. Material: Stainless steel, 0.05 inch thick.
    - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).
  - 4. Outside Diameter: 1-1/4 inches .
  - 5. Configuration and Length: As indicated on Drawings .
- C. Mirror Unit: Bobrick B-290 2436 **[MR1]**
  - 1. Frame: Stainless-steel angle, 0.05 inch thick.
    - a. Corners: Welded and ground smooth.

2. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
    - a. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
    - b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
  3. Size: 24" x 36".
- D. Surface Mounted Toilet Tissue Dispenser: Bobrick B-685 **[TP1]**
1. Single-roll toilet tissue dispenser shall be type-304 stainless steel with satin finish. Unit shall accommodate one standard-core toilet paper roll up to 5-1/2" (140mm) diameter (1800 sheets). Flanges and support arms shall be 22- gauge (0.8mm) and equipped with concealed, 16-gauge (1.6mm) mounting brackets that are secured to concealed, 16-gauge (1.6mm) wall plates with stainless steel setscrews. \*Spindle shall be chrome-plated plastic with a heavyduty internal spring
- E. Double Robe Hook: Bobrick B-6727 **[RH1]**
1. Surface-mounted double robe hook shall be type-304 stainless steel with satin finish. Flange and support arm shall be 22 gauge (0.8mm) and equipped with a concealed, 16-gauge (1.6mm) mounting bracket that is secured to a concealed, 16-gauge (1.6mm) wall plate with a stainless steel setscrew. Cap shall be 10 gauge (3.6mm), welded to the support arm.
- F. Hand Dyer: **[HD1]**
1. Manufactures: Subject to compliance with requirements, provide products by one of the following:
    - a. ASI-American Specialties, Inc.
    - b. Bobrick Washroom Equipment, Inc.
    - c. Bradley Corporation.
    - d. Dyson Inc.
    - e. Excel Dryer Inc.
  2. Description: High-speed, warm -air hand dryer for rapid hand drying. Basis of Design: Dyson Airblade V
  3. Mounting: Surface mounted.
    - a. Protrusion Limit: Installed unit protrudes maximum 4 inches from wall surface.
  4. Maximum Sound Level: 75 dB.
  5. Cover Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
  6. Touch-free capacitive sensor activation
- G. Baby Changing Station: Bobrick KB200-01SS **[BC1]**
1. Horizontal wall mounted with stainless steel veneer.
- H. Sanitary Napkin Disposal: Bobrick B-270 **[SN1]**
1. Surface-mounted sanitary napkin disposal shall be stainless steel, ASTM A480/A480M No. 4 finish (satin). Door or cover to be self-closing, disposal-opening cover and hinged face panel with tumbler lockset.

## 2.3 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

### 3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

## SECTION 104310 SIGNAGE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Panel signs.
- B. Related Sections include the following:
  - 1. Division 1 Section "Temporary Facilities and Controls" for temporary Project identification signs and for temporary information and directional signs.

#### 1.3 DEFINITIONS

- A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for signs.
  - 1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
  - 2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:
  - 1. Acrylic sheet.
- D. Sign Schedule: Use same designations indicated on Drawings.
- E. Qualification Data: For Installer and fabricator.
- F. Maintenance Data: For signs to include in maintenance manuals.

- G. Warranty: Special warranty specified in this Section.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.
- D. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

## 1.6 COORDINATION

- A. Coordinate placement of anchorage devices with templates for installing signs.

## 1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Deterioration of embedded graphic image colors and sign lamination.
  - 2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.
- B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.

## 2.2 INTERIOR PANEL SIGNS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. 2/90 Sign Systems (used as basis of design)
  - 2. Acorn Sign Graphics
  - 3. Best Sign Systems Inc.
- B. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner, complying with the following requirements:
  - 1. High-Pressure Decorative Laminate: 0.048 inch thick.
  - 2. Edge Condition: Square cut.
  - 3. Mounting: Unframed.
    - a. Wall mounted with concealed anchors.
    - b. Manufacturer's standard anchors for substrates encountered.
  - 4. Custom Paint Colors: Match Pantone color matching system.
  - 5. Color: As selected by Owner from manufacturer's full range.
  - 6. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch above surface with contrasting colors.
- C. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
  - 1. Panel Material: Opaque acrylic sheet.
  - 2. Raised-Copy Thickness: Not less than 1/32 inch.
- D. Engraved Copy: Machine engrave letters, numbers, symbols, and other graphic devices into panel sign on face indicated to produce precisely formed copy, incised to uniform depth.
- E. Custom Acrylic Sign [EQ1] : Custom Acrylic Sign with custom digitally printed graphic on standoffs.
  - 1. Panel Material: Opaque acrylic sheet.
  - 2. Mounting: Through grip stainless steel round stand offs.

## 2.3 ACCESSORIES

- A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for

drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

## 2.4 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
  - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
  - 2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.
- B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
  - 1. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
- C. Dimensional Characters: Mount characters using standard fastening methods to comply with manufacturer's written instructions for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.

### 3.2 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

### 3.3 SCHEDULE OF INTERIOR PANEL SIGNS

- A. Provide the quantity of each type scheduled on drawings, text copy and locations to be verified.

END OF SECTION

SECTION 104413  
FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Fire protection cabinets for the following:
    - a. Portable fire extinguishers.
- B. Related Sections:
  - 1. Division 10 Section "Fire Extinguishers."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.
  - 1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Initial Selection: For each type of fire protection cabinet indicated.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

- B. Coordinate sizes and locations of fire protection cabinets with wall depths.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
  - 1. Sheet: ASTM B 209
  - 2. Extruded Shapes: ASTM B 221
- C. Stainless-Steel Sheet: ASTM A 666, Type 304.
- D. Acrylic Bubble: One piece.

### 2.2 FIRE PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Fire End & Croker Corporation.
    - b. J. L. Industries, Inc., a division of Activar Construction Products Group.
    - c. Kidde Residential and Commercial Division, Subsidiary of Kidde plc.
    - d. Larsen's Manufacturing Company.
    - e. Potter Roemer LLC; Series 1772 (*Basis of Design*).
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Aluminum sheet.
- D. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
  - 1. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.
- E. Cabinet Trim Material: Aluminum sheet.
- F. Door Material: Aluminum sheet.
- G. Door Style: Vertical Duo.

- H. Door Glazing: Clear Acrylic.
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
  - 1. Provide recessed door pull and friction latch.
  - 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- J. Accessories:
  - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
  - 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
    - a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
      - 1) Location: Applied to cabinet door.
      - 2) Application Process: Silk-screened.
      - 3) Lettering Color: White.
      - 4) Orientation: Vertical.
- K. Finishes:
  - 1. Manufacturer's standard baked-enamel paint for the following:
    - a. Interior of cabinet.
  - 2. Aluminum: Clear anodic.

## 2.3 FABRICATION

- A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
  - 1. Weld joints and grind smooth.
  - 2. Provide factory-drilled mounting holes.
  - 3. Prepare doors and frames to receive locks.
  - 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
  - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
  - 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

## 2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.5 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

## 2.6 STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## 2.7 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
  - 1. Run grain of directional finishes with long dimension of each piece.
  - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
  - 3. Directional Satin Finish: No. 4.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare recesses for semirecessed fire protection cabinets as required by type and size of cabinet and trim style.

### 3.3 INSTALLATION

- A. General: Install fire protection cabinets in locations and at mounting heights indicated.
  - 1. Fire Protection Cabinets: 48 inches (1219 mm) above finished floor to top of cabinet.
- B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
  - 1. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.

### 3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 104416  
FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers.
- B. Related Sections:
  - 1. Division 10 Section "Fire Extinguisher Cabinets."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.
- B. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
  - 1. Provide fire extinguishers approved, listed, and labeled by FMG.

## 1.6 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

## 1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Failure of hydrostatic test according to NFPA 10.
    - b. Faulty operation of valves or release levers.
  - 2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet indicated.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Fire End & Croker Corporation.
    - b. J. L. Industries, Inc.; a division of Activar Construction Products Group.
    - c. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
    - d. Larsen's Manufacturing Company.
    - e. Potter Roemer LLC.
  - 2. Valves: Manufacturer's standard.
  - 3. Handles and Levers: Manufacturer's standard.
  - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.
- C. Purple-K Dry-Chemical Type in Aluminum Container (Located in kitchen): UL-rated 10-B:C, 2.5-lb nominal capacity, with potassium bicarbonate-based dry chemical in enameled-aluminum container. Located at Kitchen.

## 2.2 MOUNTING BRACKETS

- A. Provide brackets for extinguishers not located in cabinets. Provide manufacturer's standard brackets designed to prevent accidental dislodgement of extinguisher, of sizes required for type and capacity of extinguisher indicated, in manufacturer's standard plated finish.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
  - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION

SECTION 123640  
STONE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes stone countertops.

1.2 ACTION SUBMITTALS

- A. Product Data: For each variety of stone, stone accessory and manufactured product.
- B. Shop Drawings:
  - 1. Include plans, sections, details, and attachments to other work.
  - 2. Show locations and details of joints.
  - 3. Show direction of veining, grain, or other directional pattern.
- C. Samples for Verification: For each stone type indicated, in sets of Samples not less than 12 inches square.
  - 1. Include two or more Samples in each set and show the full range of variations in appearance characteristics expected in the completed Work.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Material Test Reports:
  - 1. Stone Test Reports: For each stone variety proposed for use on Project, by a qualified testing agency, indicating compliance with required physical properties, according to referenced ASTM standards. Base reports on testing done within previous five years.
  - 2. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer indicating that sealants will not stain or damage stone.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For stone countertops to include in maintenance manuals. Include product data for stone-care products used or recommended by Installer, and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate

stone countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

- B. Installer Qualifications: Fabricator of stone countertops.

#### 1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturer, for compatibility and adhesion testing according to sealant manufacturer's standard testing methods and according to Section 079200 "Joint Sealants," Samples of materials that will contact or affect joint sealants.

#### 1.7 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of construction to receive stone countertops by field measurements before fabrication.

### PART 2 - PRODUCTS

#### 2.1 SOURCE LIMITATIONS

- A. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from a single quarry with resources to provide materials of consistent quality in appearance and physical properties.
  - 1. For stone types that include same list of varieties and sources, provide same variety from same source for each.

#### 2.2 GRANITE [GT-1], [GT-2]

- A. Material Standard: Comply with ASTM C615/C615M.
- B. Description: Uniform, ubatuba-look with vibrant gold fleck appearance.
- C. Cut stone from contiguous, matched slabs in which natural markings occur.
- D. Finish: Polished.
- E. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

#### 2.3 ADHESIVES, GROUT, SEALANTS, AND STONE ACCESSORIES

- A. Sealant for Countertops: Manufacturer's standard sealant that complies with applicable requirements in Section 079200 "Joint Sealants" and that will not stain the stone it is applied to.
  - 1. Mildew-Resistant Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, silicone.
  - 2. Joint Sealant: Single component, nonsag, neutral curing, silicone; Class 25.
  - 3. Color: As selected by Architect from manufacturer's full range.

- B. Plywood Subtops: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.
- C. Stone Cleaner: Specifically formulated for stone types, finishes, and applications indicated, as recommended by stone producer. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.

## 2.4 STONE FABRICATION, GENERAL

- A. Select stone for intended use to prevent fabricated units from containing cracks, seams, and starts that may impair structural integrity, function, or appearance.
- B. Grade and mark stone for final locations to produce assembled countertop units with an overall uniform appearance.
- C. Fabricate stone countertops in sizes and shapes required to comply with requirements indicated.
  - 1. Clean sawed backs of stones to remove rust stains and iron particles.
  - 2. Dress joints straight and at right angle to face unless otherwise indicated.
  - 3. Cut and drill sinkages and holes in stone for anchors, supports, and attachments.
  - 4. Provide openings, reveals, and similar features as needed to accommodate adjacent work.
  - 5. Fabricate molded edges with machines having abrasive shaping wheels made to reverse contour of edge profile to produce uniform shape throughout entire length of edge and with precisely formed arris slightly eased to prevent snipping, and matched at joints between units. Form corners of molded edges as indicated with outside corners slightly eased unless otherwise indicated.
  - 6. Finish exposed faces of stone to comply with requirements indicated for finish of each stone type required and to match approved Samples and mockups. Provide matching finish on exposed edges of countertops, splashes, and cutouts.
- D. Carefully inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units.

## 2.5 STONE COUNTERTOPS

- A. General: Comply with recommendations in MIA's "Dimension Stone - Design Manual VII."
- B. Nominal Thickness: Provide thickness indicated, but not less than 1-1/4 inches. Gage backs to provide units of identical thickness.
- C. Edge Detail: Straight, slightly eased at top.
- D. Splashes: Provide 3/4-inch- thick backsplashes and end splashes unless otherwise indicated.
  - 1. Height: 4 inches.

2. Top-Edge Detail: Straight, slightly eased at corner.

E. Joints:

1. Fabricate countertops without joints.
2. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long may result, unless unavoidable.
3. Joint Type, Sealant Filled: 1/16 inch in width.
4. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit.

F. Cutouts and Holes:

1. Counter-Mounted Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
2. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates to receive stone countertops and conditions under which stone countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone countertops.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of stone countertops.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Advise installers of other work about specific requirements for placement of inserts and similar items to be used by stone countertop Installer for anchoring stone countertops. Furnish installers of other work with Drawings or templates showing locations of these items.
- B. Before installing stone countertops, clean dirty or stained stone surfaces by removing soil, stains, and foreign materials. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives and rinse with clear water. Allow stone to dry before installing.

### 3.3 CONSTRUCTION TOLERANCES

- A. Variation from Level: Do not exceed 1/8 inch in 96 inches, 1/4 inch maximum.
- B. Variation in Joint Width: Do not vary joint thickness more than one-fourth of nominal joint width.
- C. Variation in Plane at Joints (Lipping): Do not exceed 1/64-inch difference between planes of adjacent units.
- D. Variation in Line of Edge at Joints (Lipping): Do not exceed 1/64-inch difference between edges of adjacent units, where edge line continues across joint.

### 3.4 INSTALLATION OF COUNTERTOPS

- A. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- B. Install countertops over subtops with full spread of water-cleanable epoxy adhesive.
- C. Install countertops by adhering to supports with water-cleanable epoxy adhesive.
- D. Do not cut stone in field unless otherwise indicated. If stone countertops or splashes require additional fabrication not specified to be performed at Project site, return to fabrication shop for adjustment.
- E. Do necessary field cutting as stone is set. Use power saws with diamond blades to cut stone. Cut lines straight, true, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- F. Set stone to comply with requirements indicated. Shim and adjust stone to locations indicated, with uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances. Install anchors and other attachments indicated or necessary to secure stone countertops in place.
- G. Space joints with 1/16-inch gap for filling with sealant. Use temporary shims to ensure uniform spacing.
  - 1. Install metal splines in kerfs in stone edges at joints. Fill kerfs with sealant before inserting splines and remove excess immediately after adjoining units are drawn into position.
  - 2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- H. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Use power saws with diamond blades to cut stone. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

- I. Install backsplashes and end splashes by adhering to wall with water-cleanable epoxy adhesive. Leave 1/16-inch gap between countertop and splashes for filling with sealant. Use temporary shims to ensure uniform spacing.
- J. Grout joints to comply with ANSI A108.10. Remove temporary shims before grouting. Tool grout uniformly and smoothly with plastic tool.
- K. Apply sealant to joints; comply with Section 079200 "Joint Sealants." Remove temporary shims before applying sealant.

### 3.5 ADJUSTING AND CLEANING

- A. In-Progress Cleaning: Clean countertops as work progresses. Remove adhesive, grout, mortar, and sealant smears immediately.
- B. Remove and replace stone countertops of the following description:
  - 1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
  - 2. Defective countertops.
  - 3. Defective joints, including misaligned joints.
  - 4. Interior stone countertops and joints not matching approved Samples and mockups.
  - 5. Interior stone countertops not complying with other requirements indicated.
- C. Replace in a manner that results in stone countertops matching approved Samples and mockups, complying with other requirements, and showing no evidence of replacement.
- D. Clean stone countertops no fewer than six days after completion of sealant installation, using clean water and soft rags. Do not use wire brushes, acid-type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods that may damage stone.
- E. Sealer Application: Apply stone sealer to comply with stone producer's and sealer manufacturer's written instructions.

END OF SECTION

SECTION 220400  
GENERAL REQUIREMENTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY – SECTION INCLUDES

- A. Section Includes: Every item of labor, materials, equipment and appurtenances for installing Plumbing Systems included in Division 22 of the Specifications.
- B. Related Sections:
  - 1. Section 078413 – Penetration Fire Stopping
  - 2. Section 22 05 23 – General-Duty Valves for Plumbing Piping
  - 3. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
  - 4. Section 22 05 53 – Painting and Identification for Plumbing Piping and Equipment
  - 5. Section 22 07 00 – Plumbing Insulation
  - 6. Section 22 11 16 – Domestic Water Piping
  - 7. Section 22 11 19 – Domestic Water Piping Specialties
  - 8. Section 22 13 16 – Sanitary Waste and Vent Piping
  - 9. Section 22 13 19 – Sanitary Waste Piping Specialties

1.3 DRAWINGS

- A. The Plumbing Drawings are diagrammatic in nature and show the general arrangement of all piping, equipment and appurtenances and shall be followed as closely as actual building construction and the work of other trades will permit. Because of the small scale of the Plumbing Drawings, it is not feasible to indicate all offsets, fittings and accessories that may be required. The Contractor shall investigate the construction conditions affecting the work and provide fittings and accessories as required to meet actual conditions.
- B. Where discrepancies in scope of work as to which Trade provides specific items, such as starters, disconnects, flow switches, electrical control components, etc. exist, such conflicts shall be reported to the Engineer. If such action is not taken, the Contractor, as applicable, shall furnish such items as part of his work, for complete and operable systems and equipment, as determined by the Engineer.

#### 1.4 REGULATIONS AND STANDARDS

- A. The completed installation and all materials and equipment shall conform to local ordinances and codes, other regulations and standards listed herein or in related sections. These are intended as a minimum and shall be exceeded if required by the specifications or the Drawings. In the event of conflict between the codes, standards, or regulations, and information contained in the Contract Documents, the applicable code, standards, or regulation shall take precedence.

#### 1.6 ASBESTOS

- A. Asbestos Free Materials: The intention of these Drawings and specifications is that there are no asbestos-containing materials installed on this project. To the best of the Architects and Engineers knowledge, none of the material or equipment specified herein or shown on the Drawings contains asbestos. The Contractor shall make every effort to prevent any asbestos materials from being installed in or used on the construction of the project.
- B. Existing Materials:
  - 1. **Refer to the asbestos enclosure on sheet T001 for information on existing materials containing asbestos in the building.**

#### 1.7 MATERIALS AND WORKMANSHIP

- A. Equipment and material used in the project shall be new and undamaged. The Plumbing installation shall fit into the space allotted and shall allow adequate and acceptable clearances for entry, servicing and maintenance. Similar types of equipment shall be the products of the same manufacturer unless specified otherwise. Work shall be performed by mechanics or tradesmen skilled in the trade involved.
- B. All piping and equipment shall be installed in a neat and organized manner, parallel to other work and the nearest building elements, unless specifically shown otherwise on the Drawings.
- C. Equipment and materials shall be suitable for use in the environment in which they are installed. Equipment exposed to outside conditions shall be adequately protected from the weather, manufactured from materials suitable for outdoor use, and designed specifically for use in outdoor environments.

#### 1.8 SUBMITTALS

- A. Submit shop drawings, product data and samples in accordance with Division 01 for all items as specified in related sections of these specifications.
- B. Equivalents: Manufacturers, trade names, and model numbers indicated herein and on Drawings shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. Unless definitely stated otherwise and upon complying with Division 1, the Contractor may use any article which, in his judgment is equal to that specified and is accepted by the Engineer. It will be the responsibility of the Contractor to verify all connections, physical sizes, capacities, etc. of all other manufacturer's items, both named or proposed. If the equipment necessitates

changes in rough-in, piping, wiring or other building systems from that indicated on the Drawings, the Contractor shall be responsible for all additional costs included and notify other trades. Where such changes are required, detail drawings indicating all required changes shall be submitted for review at the same time the manufacturers drawings are submitted for approval.

- E. Operation and Maintenance manual(s) shall be submitted in accordance with Division 01, this Section and shall include a complete product index in each volume, installation and maintenance data, parts lists, a copy of all approved shop drawings and the name, address and telephone number of supplier or nearest representative.

#### 1.9 WARRANTY

- A. Comply with Division 01 for warranty requirements.
- B. Information on all warranties shall be included in the O&M Manuals specified herein to be provided to the Owner.

#### 1.10 EXCAVATION AND BACKFILLING

- A. General: Excavation and backfilling shall be as specified in Division 31. Backfilling shall not commence until all tests have been performed and all utility systems conform to the Contract Documents.
- B. Protection of Existing Utilities: Existing utility lines to be retained, whether known or unknown and uncovered during excavation operations, shall be protected from damage during excavation and backfilling, and if damaged, shall be restored to original condition.

#### 1.11 VERIFYING MEASUREMENTS AND CONDITIONS

- A. The exactness of grades, elevations, dimensions, or locations given on the Drawings, is not guaranteed by the Engineer. The Contractor shall, therefore, satisfy himself as to the accuracy of all grades, elevations, dimensions and locations. In all cases of interconnection of his work with existing or other work, he shall verify at the site all dimensions relating to such existing or other work. Any errors due to the Contractor's failure to so verify all such grades, elevations, locations, or dimensions shall be promptly rectified by him without cost to Owner.

#### 1.12 INTERRUPTION OF UTILITY SERVICES

- A. It is necessary that close liaison be maintained with the Administrative Authorities in all matters affecting interruptions of any utility services serving the facility and existing buildings. Prior to interrupting any utility service, the Administrative Authorities shall be consulted and interruptions for connections made at a time (or times) suitable to the Administrative Authorities. Work shall be laid out and planned to limit the interruption times to a minimum.

#### 1.13 COORDINATION OF WORK

- A. General: The Contract Documents indicate the extent and general arrangement of the Plumbing systems. The Contractor shall be responsible for the coordination and proper relation of the Plumbing work to the building structure and to the work of other

trades. No additional compensation or extension of completion time will be granted for extra work caused by the lack of coordination.

- B. Cooperation: The Contractor shall provide dimensions and locations of all openings, shafts and similar items to the proper trades and install work as required so as not to interfere with, or delay, the building construction.
- C. Locations of lines and equipment shall be determined from actual field measurements. The outlines of the building shown on the Plumbing Drawings are intended only as a guide to indicate relative locations of the Plumbing work. Refer to Architectural and Structural Drawings for building construction details. The Contractor shall determine the exact routing and location of his systems prior to fabrication or installation of any system component. Accurate measurements and coordination shall be completed to verify dimensions and characteristics for the installation of each system.
- D. Unless necessitated by equipment access or otherwise indicated in the Contract Documents, all equipment, piping and conduit concealed above ceilings and in finished or utility spaces shall be routed as high as possible.
- E. Offsets, transitions and changes of direction in all systems shall be made as required to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings. The Contractor shall provide manual air vents and drains as required for his work to affect these offsets, transitions and changes in direction, as applicable.
- F. Cutting and Patching: Comply with requirements for cutting and patching specified in Division 01.
- G. Roughing-In: Verify the locations of machines, door swings, block coursing, alignment of tile end and other similar features before roughing-in for Plumbing equipment components and/or controls.
- H. Damage to Other Work: Each Contractor is responsible for damage to other work caused by his work or workmen. Repairing of damaged work shall be done by the Contractor who installed the work, and as directed by the Architect-Engineer; the cost of which shall be paid for by the Contractor responsible for the damage.

#### 1.14 EQUIPMENT INSTALLATION

- A. General: Equipment shall be installed in accordance with manufacturer's instructions to conform with the details and application indicated. Where manufacturer's recommendations or installation instructions require options or accessories not specified, they shall be included and installed by the Contractor.
- B. Supports: Provide necessary supports for all equipment and appurtenances as required; this includes but is not limited to frames or supports for items such as storage tanks, water heaters, air compressors, plumbing fixtures, pumps, valves, and other similar items requiring supports. Floor mounted equipment in Equipment Rooms shall be set on 4-inch high concrete foundation pads unless shown otherwise. All pads shall be poured such that the top of the pad is level. Foundation drawings, bolt setting information and foundation bolts shall be furnished by the subcontractors furnishing the equipment for all equipment required to have concrete

foundations. Concrete for foundations shall be provided by Plumbing Subcontractor unless indicated otherwise. Except where indicated all equipment shall be anchored to concrete pads.

- C. Service Area: All equipment and appurtenances shall be located to permit adequate service clearance in accordance with manufacturer's recommendations and as otherwise required. Service clearance shall include but not be limited to service and removal of plumbing system, water heaters, pumps, motors, controls and other of equipment. All piping and other equipment shall be located outside of the service area or shall be flanged for easy removal to facilitate equipment service. All equipment shall be located with sufficient distance from building features, structural components, and the equipment of other trades. Service clearance in front of electrical panels shall be the minimum as required by National Electric Code (NEC) where applicable.
- D. Temporary Requirements: Openings in equipment shall be kept plugged at all times until connection is made to the system. The ends of all pipes and equipment openings shall be kept plugged or capped properly with approved devices. Approved devices are items such as specially molded plastic caps, pipe plugs, test plugs and sheet metal caps.

#### 1.15 EXISTING EQUIPMENT

- A. General: Care shall be exercised to protect all existing equipment to be reused. The Contractor shall remove from operation all equipment that is shown to be reused and provide adequate protection including but not limited to prevention of corrosion, protection of seals, prevention of leaking, and prevention of internal/external contamination. All electronic components shall be protected from weather and moisture, deterioration and loss of programming.

#### 1.16 SLEEVES AND INSERTS

- A. General: Sleeves and inserts shall be provided and correctly located in the structure, as require for the work.
- B. Inserts shall be steel and proper size for loads encountered.
- C. Sleeves shall be provided for all pipes passing through concrete or masonry walls, partitions, concrete beams or slabs installed during construction of the wall, partition, beam or slab. All penetrations through nonfireresistance rated floor assemblies and through the ceiling membrane of nonfireresistance rated roof assemblies shall be fireblocked with tightly packed mineral-wool insulation secured in place. All penetrations through equipment room walls and other areas of noise or heat generation shall be tightly sealed with mineral fiber rope.

#### 1.17 ESCUTCHEONS

- A. Where pipes pass through floors, walls or ceilings in finished rooms, they shall be fitted with chromium plated escutcheons of suitable pattern to effectively cover the rough opening. Where sleeves project above floors, special deep type escutcheons shall be provided.

## 1.18 ACCESS DOORS

- A. Provide for all concealed valves, controls, dampers, junction boxes, equipment, or any item requiring access. Doors shall be of sufficient size and so located that the concealed items may be serviced or completely removed and replaced. Doors required for Plumbing work shall be furnished as a part of this Division to the General Contractor for installation. The Plumbing Sub-Contractor shall provide locations of all access doors such that service may be safely performed from a ladder, lift, or platform without the need for support from the ceiling system. Doors in acoustic tile ceilings shall be furnished in multiples of tile sizes. Doors are not required in exposed grid type ceilings where tiles are removable. Doors shall be metal access doors with cam lock, style to match ceiling or wall construction. Doors occurring in rated construction shall be fire rated U.L. labeled access doors correlated to preserve the integrity of the rated construction. Doors leading to concealed spaces shall be provided with means to open from the inside. Doors shall be prime finish steel except those in toilets, shower rooms, locker rooms, kitchens and other similar areas shall be stainless steel with brushed finish.

## 1.19 INSTRUCTION OF OWNER'S REPRESENTATIVE

- A. Contractors shall instruct the representative of the Owner in the proper operation and maintenance of all elements of the Plumbing systems. Competent representatives of the Contractor shall spend such time as necessary to fully prepare the Owner to operate and maintain the Plumbing systems.

## 1.20 FIRESTOPPING

- A. Refer to specification section 078413, "Penetration Firestopping" for requirements related to piping penetrations through rated walls and partitions. All piping penetrations through rated walls shall be compliant with specification section 078413, "Penetration Firestopping".**

## PART 2 - PRODUCTS – NOT USED

## PART 3 - EXECUTION

### 3.1 PHASING OF WORK

- A. Coordinate phasing requirements with Division 01.

### 3.2 DEMOLITION

- A. Contractor shall visit site before bidding to determine extent of demolition.
- B. Removal of Piping and Equipment: Remove all piping connections and equipment, plugging outlets, etc., such that are not required for present equipment and fixtures, or are not reused or needed for reconnecting new equipment and fixtures. Remove all equipment, fixtures, etc., indicated to be removed, or not reused or needed after the renovations are complete.
- C. Where piping or other similar items passing through rated assemblies are removed; the assemblies shall be patched in accordance with UL so as to maintain the integrity of the assembly.

- D. The Owner will select and retain such existing plumbing fixtures, equipment and materials which are indicated to be removed and not reused, as he desires. All other existing plumbing fixtures, equipment and materials indicated to be removed and not reused shall become the property of the Contractor, who shall promptly remove them from the premises. All existing equipment and fixtures indicated to be relocated shall be disconnected, removed, relocated and reconnected. All equipment and fixtures shall be protected from damage during demolition.
- E. Miscellaneous: In all altered portions of the buildings, the Contractor shall remove or alter as necessary all existing Plumbing work that is not coordinated to operate with the new construction. Demolition shall not begin until the work schedule is approved by the owner. The work shall be scheduled to prevent any disruption to the normal operations of the building.

END OF SECTION

SECTION 220523  
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Bronze ball valves.
2. Bronze swing check valves.
3. Bronze globe valves.

B. Related Sections:

1. Section 22 04 00 – General Requirements for Plumbing
2. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
3. Section 22 05 53 – Painting and Identification for Plumbing Piping and Equipment
4. Section 22 07 00 – Plumbing Insulation
5. Section 22 11 16 – Domestic Water Piping
6. Section 22 11 19 – Domestic Water Piping Specialties
7. Section 22 13 16 – Sanitary Waste and Vent Piping
8. Section 22 13 19 – Sanitary Waste Piping Specialties

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.4 SUBMITTALS

- A. Product Data: Comply with requirements for submittals in Division 01 and Section 22 04 00 "General Requirements for Plumbing".

## 1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 2. ASME B31.1 for power piping valves.
  - 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set gate, and globe valves closed to prevent rattling.
  - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
  - 5. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
  - 1. Handlever: For quarter-turn valves NPS 6 and smaller.

- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
  - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

- F. Valve-End Connections:
  - 1. Solder Joint: With sockets according to ASME B16.18.
  - 2. Threaded: With threads according to ASME B1.20.1.

- G. Valve Bypass and Drain Connections: MSS SP-45.

## 2.2 BRONZE VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Conbraco Industries, Inc.; Apollo Valves.
    - b. Milwaukee Valve Company.
    - c. NIBCO INC.
  - 2. Description:
    - a. Standard: MSS SP-110.
    - b. SWP Rating: 150 psig.
    - c. CWP Rating: 600 psig.
    - d. Body Design: Two piece.
    - e. Body Material: Bronze.
    - f. Ends: Threaded.
    - g. Seats: PTFE or TFE.
    - h. Stem: Bronze.
    - i. Ball: Chrome-plated brass.
    - j. Port: Full.

## 2.3 BRONZE SWING CHECK VALVES

### A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Milwaukee Valve Company.
  - b. NIBCO INC.
  - c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-80, Type 3.
  - b. CWP Rating: 200 psig.
  - c. Body Design: Horizontal flow.
  - d. Body Material: ASTM B 62, bronze.
  - e. Ends: Threaded.
  - f. Disc: Bronze.

## 2.4 BRONZE GLOBE VALVES

### A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Milwaukee Valve Company.
  - b. NIBCO INC.
  - c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-80, Type 1.
  - b. CWP Rating: 200 psig.
  - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
  - d. Ends: Threaded or solder joint.

- e. Stem and Disc: Bronze.
- f. Packing: Asbestos free.
- g. Handwheel: Malleable iron, bronze, or aluminum.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.

### 3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

### 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball, valves.
  - 2. Throttling Service: Ball or globe valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

- C. Select valves, except wafer types, with the following end connections:
1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
  2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

END OF SECTION

SECTION 220529  
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.

B. Related Sections:

1. Section 05 50 00 – Metal Fabrications
2. Section 22 04 00 – General Requirements for Plumbing
3. Section 22 05 23 – General – Duty Valves for Plumbing Piping
4. Section 22 05 53 – Painting and Identification for Plumbing Piping and Equipment
5. Section 22 07 00 – Plumbing Insulation
6. Section 22 11 16 – Domestic Water Piping
7. Section 22 11 19 – Domestic Water Piping Specialties
8. Section 22 13 16 – Sanitary Waste and Vent Piping
9. Section 22 13 19 – Sanitary Waste Piping Specialties
10. Section 22 16 16 – Gas Piping Systems

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

## 1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to SEI/ASCE 7 "Minimum Design Loads for Buildings and Other Structures."
  - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

## 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Comply with requirements in Division 01 and Section 22 04 00 "General Requirements for Plumbing".
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
  - 1. Trapeze pipe hangers.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Detail fabrication and assembly of trapeze hangers.
  - 2. Design Calculations: Calculate requirements for designing trapeze hangers.
- D. Welding certificates.

## 1.6 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

## PART 2 - PRODUCTS

### 2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
  3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:
1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
  2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel, stainless steel or cadmium plated steel.

## 2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

## 2.3 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Carpenter & Paterson, Inc.
  2. Clement Support Services.
  3. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## 2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

## 2.5 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping.
- I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- K. Insulated Piping:
  1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  4. Shield Dimensions for Pipe: Not less than the following:

- a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
  - b. NPS 4: 12 inches long and 0.06 inch thick.
  - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
5. Insulated Pipes NPS 2 1/2 inches and Larger: Include reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
  6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.2 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.3 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### 3.4 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  - 2. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  - 3. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 4. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 5. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
  2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  4. C-Clamps (MSS Type 23): For structural shapes.
  5. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  6. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  7. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  8. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 220553  
PAINTING AND IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Identification of piping in exposed and accessible locations.

- B. Not Included in Section:

- 1. Painting of piping or equipment exposed in finished areas other than those listed under "Section Includes" above.

- C. Related Sections:

- 1. Section 22 04 00 – General Requirements for Plumbing
  - 2. Section 22 05 23 – General – Duty Valves for Plumbing Piping
  - 3. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
  - 4. Section 22 07 00 – Plumbing Insulation
  - 5. Section 22 11 16 – Domestic Water Piping
  - 6. Section 22 11 19 – Domestic Water Piping Specialties
  - 7. Section 22 13 16 – Sanitary Waste and Vent Piping

1.3 SUBMITTALS

- A. For each type of Product indicated. Comply with requirements in Division 01 and Section 22 04 00 "General Requirements for Plumbing.

1.4 REFERENCED STANDARDS

- A. General: The following standards or codes (latest edition) form a part of this specification to the extent indicated by the reference thereto.
- B. American National Standards Institute (ANSI):

ANSI A13.1                      Scheme for Identification of Piping Systems



1. All Hangers and Supports: One coat Pro-Industrial Zero VOC Acrylic Gloss Black.
- D. Valve tags shall be neat circular brass with designations stamped thereon, attached with solid brass jack chain to each valve stem or handle.
- F. All accessible piping, insulated and uninsulated, shall be identified with piping system markers and arrow flow directional marker, mechanically affixed on all piping installed under Division 22. Markers shall be pressure sensitive vinyl, 12 inches long with 1 ¼ inch high letters. Attach to piping with 2 inch wide tape with integral clear protective coating and directional arrows. Pipe markers and tape shall be in ANSI colors.

## **PART 3 - EXECUTION**

### **3.1 WORKMANSHIP**

- A. The work shall be accomplished by qualified mechanics skilled in the painting trade. Painting of equipment, piping, ductwork and other materials shall not commence until all testing is complete and systems are ready for operation. Materials shall be applied according to manufacturer's directions. All containers shall be securely closed when not in use. Flammable materials shall not be stored on premises. Flammable waste shall be disposed of daily in devices approved for such purposes. Materials shall be evenly spread, and smoothly flowed on without runs or sags. Each coat shall be thoroughly dry before application of succeeding coats.

### **3.2 PROTECTION OF WORK**

- A. The painters shall protect all adjacent surfaces with drop covers during the process of painting. Upon completion, paint spots, if any, shall be removed from all surfaces.

### **3.3 PREPARATION OF SURFACE**

- A. Surfaces to be painted shall be completely dry before applying paint. Metal surfaces shall be cleaned with mineral spirits before applying materials. Rust and scale shall be removed by wire brushing or sanding. Galvanized surfaces shall be chemically pretreated with crystalline (zinc phosphate) phosphate in strict accordance with the manufacturer's recommendations. Surfaces shall not be painted when the temperature is, or is likely to be, near the freezing point, nor when they are exposed to hot sun.

### **3.4 IDENTIFICATION OF PIPES AND EQUIPMENT**

- A. Piping: Color bands shall be painted on each pipe line where exposed or accessible. Pressure sensitive tape is prohibited. Bands shall be six inches wide and shall be placed on 15 foot intervals along the pipe run, immediately preceding the passage of the line through walls, ceiling or floor, and at each equipment connection or line valve. Bands shall be placed within 6 feet of elbows (both sides of elbows). Where pipes and/or conduits run parallel to one another, color bands shall align with adjacent bands. Where sub-bands are specified, they shall be two inches wide and centered in the color band. Adjacent to each color band, the abbreviation of the

name of the medium contained in the pipe and an arrow indicating the direction of flow shall be stenciled. Stencil letters shall be one-half inch high upper case, applied with Series 54 Black Gloss Enamel. Color bands shall be Series 54 Alkyd Gloss Enamel of the following colors, except aluminum color paint shall be NO. B59S11 aluminum paint.

Pipe Medium	Abbrev.	Band Color	Sub Band
Domestic Cold Water	CW	Green	None
Domestic Hot Water	HW	Green	Red
H.W. Recirculating	HWR	Green	Pink
Sanitary Drain	DRAIN	Orange	Black

B. Apply piping system markers after completion of required insulation and finishes on piping systems. Markers shall be applied in the following locations and where identified by the Engineer:

1. At each valve and at connection to equipment.
2. At every tee and branch connection.
3. At each riser including branch risers from mains.
4. At each side of a pipe passage through floors, walls and partitions.
5. Every 15 feet on straight runs of piping mains and branches.
6. Provide arrow markers showing direction of flow incorporated into, or adjacent to, each piping system marker.
7. Apply all piping system markers where view is unobstructed, and legends can be read and easily identified.
8. Apply all tags and piping system markers in accordance with the supplier's instructions.
9. Self-adhering identification labels shall have plastic tape wrapped around each end. The tape shall overlap itself a minimum of ½ circumference.

END OF SECTION

SECTION 220700  
PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:
  - a. Calcium silicate.
  - b. Mineral fiber.
  - c. Polyolefin.
2. Insulating cements.
3. Adhesives.
4. Sealants.
5. Factory-applied jackets.
6. Field-applied jackets.
7. Tapes.
8. Securements.
9. Corner angles.

B. Related Sections:

1. Section 22 04 00 – General Requirements for Plumbing
2. Section 22 05 23 – General – Duty Valves for Plumbing Piping
3. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
4. Section 22 05 53 – Painting and Identification for Plumbing Piping and Equipment
5. Section 22 11 16 – Domestic Water Piping

6. Section 22 11 19 – Domestic Water Piping Specialties

7. Section 22 13 16 – Sanitary Waste and Vent Piping

8. Section 22 13 19 – Sanitary Waste Piping Specialties

### 1.3 DEFINITIONS

A. Runout: Last section of pipe from branch or main to fixtures or equipment.

### 1.4 SUBMITTALS

A. Product Data: Comply with requirements in Division 01 and Section 22 04 00 “General Requirements for Plumbing”.

B. Qualification Data: For qualified Installer.

C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

D. Field quality-control reports.

### 1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

## 1.7 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

## 1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Calcium Silicate:
  - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Industrial Insulation Group (The); Thermo-12 Gold.
  - 2. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.

3. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
4. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Johns Manville; Micro-Lok.
  - b. Knauf Insulation; 1000(Pipe Insulation.
  - c. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

H. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Armacell LLC; Tubolit.
  - b. Nomaco Inc.; IMCOLOCK, IMCOSHEET, NOMALOCK, and NOMAPLY.
  - c. RBX Corporation; Therma-cell.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

2.3 SEALANTS

- A. Joint Sealants: Provide sealants either manufactured or recommended by the insulation material manufacturer.

## 2.4 TAPES

- A. Product performance is based on products manufactured by Venture Tape; there are slight variations among manufacturers listed.
- B. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
    - b. Compac Corp.; 104 and 105.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  - 2. Width: 3 inches.
  - 3. Thickness: 11.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

## 2.5 SECUREMENTS

- A. Bands:
  - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Products; Bands.
    - b. PABCO Metals Corporation; Bands.
    - c. RPR Products, Inc.; Bands.
  - 2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick 3/4 inch wide with [wing or closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

## 2.6 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
  - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Keep insulation materials dry during application and finishing.
- F. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- G. Install insulation with least number of joints practical.
- H. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- I. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
  2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- J. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- K. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- L. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  6. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  7. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
  4. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.6 CALCIUM SILICATE INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation materials.
2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.
3. Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.

### 3.7 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as

recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.8 POLYOLEFIN INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
  4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of polyolefin pipe insulation.
  2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
  2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  3. Install insulation to flanges as specified for flange insulation application.
  4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.9 FINISHES

- A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 22 05 53 "Painting and Identification for Plumbing Piping and Equipment".

### 3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.11 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Drainage piping located in crawl spaces.
  - 2. Underground piping.
  - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### 3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
  - 1. Insulation shall be the following:
    - a. Calcium Silicate: NPS 2-1/2 pipe and larger, 1 inch thick at pipe hangers. Calcium silicate shall be installed in preformed sections 12 inches long enclosing pipe around entire circumference.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
    - c. Polyolefin: 1 inch thick under floor slab and in walls and chases prior to Building "Dry-In".
  - 2. Runouts NPS 2 and smaller: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
    - b. Polyolefin: 1/2 inch thick in walls and chases prior to Building "Dry In".
- B. Domestic Hot and Recirculated Hot Water:
  - 1. NPS 2 and Smaller: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
    - b. Polyolefin: 1 inch thick under floor slab, and in walls and chases prior to building "Dry In".
  - 2. NPS 2-1/2 and Larger: Insulation shall be the following:

- a. Calcium Silicate: 1-1/2 inch thick at pipe hangers. Calcium silicate shall be installed in preformed sections 12 inches long enclosing pipe around entire circumference.
  - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1- 1/2 inches thick
  - c. Polyolefin: 1- 1/2 inches thick in walls and chases prior to Building "Dry-In".
3. Runouts NPS 2"and smaller"
- a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
  - b. Polyolefin: 1 inch thick in walls and chases prior to Building "Dry-In".

END OF SECTION

SECTION 221116  
DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
- 2. Specialty valves.
- 3. Flexible connectors.

B. Related Sections:

- 1. Section 22 04 00 – General Requirements for Plumbing
- 2. Section 22 05 23 – General – Duty Valves for Plumbing Piping
- 3. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
- 4. Section 22 05 53 – Painting and Identification for Plumbing Piping and Equipment
- 5. Section 22 07 00 – Plumbing Insulation
- 6. Section 22 11 19 – Domestic Water Piping Specialties

1.3 SUBMITTALS

- A. Product Data: Comply with requirements in Division 1 and Section 22 04 00 "General Requirements for Plumbing".

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61 for potable domestic water piping and components.

## 1.5 PROJECT CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
1. Notify Owner no fewer than seven (7) days in advance of proposed interruption of water service.
  2. Do not proceed with interruption of water service without Owner's written permission.

## PART 2 - PRODUCTS

### 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

### 2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: Under-building slab ASTM B88, Type K; above ground ASTM B 88, Type L; water tube, drawn temper.
1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
  2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
  3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
  4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
  5. Copper Pressure-Seal-Joint Fittings:
    - a. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Elkhart Products Corporation; Industrial Division.
      - 2) NIBCO INC.
      - 3) Viega; Plumbing and Heating Systems.
    - b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.

- c. NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.
- 6. Copper-Tube Extruded-Tee Connections:
  - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) T-DRILL Industries Inc.
  - b. Description: Tee formed in copper tube according to ASTM F 2014.
- B. Soft Copper Tube: Under building slab, ASTM B 88, Type K water tube, annealed temper.
  - 1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
  - 2. Copper Pressure-Seal-Joint Fittings:
    - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Elkhart Products Corporation; Industrial Division.
      - 2) NIBCO INC.
      - 3) Viega; Plumbing and Heating Systems.
    - b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
    - c. NPS 3 and NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

## 2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

## 2.4 SPECIALTY VALVES

- A. Comply with requirements in Section 22 05 23 "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Section 22 11 19 "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

## 2.5 TRANSITION FITTINGS

- A. General Requirements:
  - 1. Same size as pipes to be joined.
  - 2. Pressure rating at least equal to pipes to be joined.
  - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

## 2.6 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
  - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - b. Zurn Plumbing Products Group; Wilkins Water Control Products.
  - 2. Description:
    - a. Pressure Rating: 150 psig at 180 deg F.
    - b. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
  - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Capitol Manufacturing Company.
    - b. Central Plastics Company.

- c. EPCO Sales, Inc.
  - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
- a. Factory-fabricated, bolted, companion-flange assembly.
  - b. Pressure Rating: 150 psig
  - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

## PART 3 - EXECUTION

### 3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install shutoff valve immediately upstream of each dielectric fitting.
- D. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- H. Install piping adjacent to equipment and specialties to allow service and maintenance.
- I. Install piping to permit valve servicing.
- J. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- K. Install piping free of sags and bends.

- L. Install fittings for changes in direction and branch connections.
- M. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 04 00 "General Requirements for Plumbing."
- O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 04 00 "General Requirements for Plumbing."

### 3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- D. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- E. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
- F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### 3.3 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Section 22 05 23 "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Comply with requirements in Section 22 11 19 "Domestic Water Piping Specialties" for balancing valves.

### 3.4 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet If Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.

### 3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

### 3.7 IDENTIFICATION

- A. Identify system components. Comply with requirements Section 22 05 53 "Painting and Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

### 3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
  1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
  2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
    - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
  3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
  4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:
  1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
  2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments,

submit a separate report for each test, complete with diagram of portion of piping tested.

3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
  6. Prepare reports for tests and for corrective action required.
- D. Domestic water piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

### 3.9 ADJUSTING

- A. Perform the following adjustments before operation:
1. Close drain valves, hydrants, and hose bibbs.
  2. Open shutoff valves to fully open position.
  3. Open throttling valves to proper setting.
  4. Adjust balancing valves in hot-water return piping to provide adequate flow at indicated hot water temperature, at all times to point where hot water return pipe connects to hot water pipe.
    - a. Manually adjust balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
  5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
  6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
  8. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.10 CLEANING

#### A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
  - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
  - b. Fill and isolate system according to either of the following:
    - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
    - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
  - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
  - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

#### B. Prepare and submit reports of purging and disinfecting activities.

#### C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### 3.11 PIPING SCHEDULE

#### A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

#### B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

#### C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

#### D. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:

1. Hard or soft copper tube, ASTM B 88, Type K; wrought-copper solder-joint fittings; and brazed copper pressure-seal-joint fittings; and pressure-sealed joints.

Above ground domestic water piping, shall be the following:

2. Hard copper tube, ASTM B 88, Type cast-or wrought- copper solder-joint fittings; and brazed or soldered joints.
3. Hard copper tube, ASTM B 88, Type L copper pressure-seal-joint fittings; and pressure-sealed joints.

### 3.12 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  1. Shutoff Duty: Use ball valves for piping NPS 3 and smaller.
  2. Throttling Duty: Use ball or globe valves.
  3. Hot-Water Circulation Piping, Balancing Duty: Calibrated, Memory-stop balancing valves.
  4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION

SECTION 221119  
DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:

- 1. Temperature-Actuated Water Mixing Valves.
- 2. Strainers.
- 3. Drain Valves.
- 4. Water Hammer Arresters.
- 5. Thermometers
- 6. Pressure Gages

- B. Related Sections:

- 1. Section 22 04 00 – General Requirements for Plumbing
- 2. Section 22 05 23 – General – Duty Valves for Plumbing Piping
- 3. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
- 4. Section 22 05 53 – Painting and Identification for Plumbing Piping and Equipment
- 5. Section 22 07 00 – Plumbing Insulation
- 6. Section 22 11 16 – Domestic Water Piping
- 7. Division 26 – Electrical

1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

#### 1.4 SUBMITTALS

- A. Comply with requirements in Division 01 and Section 22 04 00 "General Requirements for Plumbing".
- B. Field quality-control test reports.
- C. Operation and Maintenance Data: For domestic water piping specialties indicated, include in emergency, operation, and maintenance manuals. Comply with requirements in Division 01 and Section 22 04 00 "General Requirements for Plumbing".

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. NSF Compliance:
  - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
  - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

### PART 2 - PRODUCTS

#### 2.5 TEMPERATURE-ACTUATED WATER MIXING VALVES

- A. Individual-Fixture, Water Tempering Valves TV:
  - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Powers model LM495-100, Leonard model 270USW, Wilkins model 12-ZW1070C.
  - 2. Standard: ASSE 1070, thermostatically controlled water tempering valve.
  - 3. Pressure Rating: 125 psig minimum, unless otherwise indicated.
  - 4. Body: Bronze body with corrosion-resistant interior components.
  - 5. Temperature Control: Adjustable.
  - 6. Inlets and Outlet: Copper Union Threaded or Union Sweat.
  - 7. Finish: Rough or chrome-plated bronze.
  - 8. Factory Tempered-Water Setting: 105 deg F.
  - 9. Tempered-Water Design Flow Rate: 4 GPM at 5 psig pressure loss.

## 2.6 STRAINERS FOR DOMESTIC WATER PIPING

### A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
  - a. Strainers NPS 2 and Smaller: 0.020 inch.
  - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
6. Drain: Pipe plug NPS 2 and Smaller, Factory-installed, hose-end drain valve NPS 2-1/2 to NPS 4.

## 2.7 WATER HAMMER ARRESTERS (SHOCK ABSORBERS)

### A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. JOSAM.
  - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - c. Tyler Pipe; Wade Div.
  - d. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows or Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.
5. Shall be provided at all fast opening valves and fixture as required by the Virginia Plumbing Code.

## 2.8 FILLED-SYSTEM THERMOMETERS

### A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Ashcroft Inc.
  - b. Marsh Bellofram.
  - c. Weiss Instruments, Inc.
2. Standard: ASME B40.200.
3. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Element: Bourdon tube or other type of pressure element.
5. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.
6. Dial: Non-reflective aluminum with permanently etched scale markings 0 deg F to 200 deg f.
7. Pointer: Dark-colored metal.
8. Window: Glass or plastic.
9. Ring: Metal.
10. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device with ASME B1.1 screw threads.
11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
  - a. Design for Thermowell Installation: Bare stem.
12. Accuracy: Plus or minus 1 percent of scale range.

B. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Type: Stepped shank unless straight or tapered shank is indicated.
5. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.

6. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
7. Bore: Diameter required matching thermometer bulb or stemming.
8. Insertion Length: Length required matching thermometer bulb or stemming.
9. Lagging Extension: Include on thermowells for insulated piping and tubing.
10. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
11. Heat-Transfer Medium: Mixture of graphite and glycerin.

## 2.9 PRESSURE GAGES

### A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. AMETEK, Inc.; U.S. Gauge.
  - b. Ashcroft Inc.
  - c. Weiss Instruments, Inc.
2. Standard: ASME B40.100.
3. Case: Liquid-filled type; cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in 0 psig to 160 psig, 20 psig figure intervals, 2psig graduation marks.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

- B. Snubbers: ASME B40.100, brass; with NPS 1/4 ASME B1.20.1 pipe threads and piston porous-metal-type surge-dampening device. Include extension for use on insulated piping.
- C. Valves: Brass ball with NPS 1/4, ASME B1.20.1 pipe threads.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with requirements in other Division 22 Sections for piping joining materials, joint construction, and basic installation requirements.
- B. Install balancing valves in locations where they can easily be adjusted.
- C. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
  - 1. Install thermometers and water regulators if specified.
  - 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- D. Install Y-pattern strainers for water on supply side of each solenoid valve, and pump.
- E. Install outlet boxes recessed in wall with face plate flush with finished wall.
- F. Install hose stations with check stops or shutoff valves on inlets and with thermometer on outlet.
  - 1. Install shutoff valve on outlet if specified.
  - 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- G. Install water hammer arresters in water piping according to PDI-WH 201.
- H. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- I. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.
- J. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- K. Install thermowells with extension on insulated piping.
- L. Fill thermowells with heat-transfer medium.
- M. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

- N. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- O. Install valve and snubber in piping for each pressure gage for fluids.
- P. Install test plugs in piping tees.
- Q. Install thermometers in the following locations:
  - 1. Inlet and outlet of each domestic hot-water storage tank.
  - 2. Inlet of each hot water circulating pump.
- R. Install pressure gages in the following locations:
  - 1. Building water service entrance into building.
  - 2. Suction and discharge of each domestic water booster pump.

### 3.2 CONNECTIONS

- A. Comply with requirements, for piping installation, in Sections 22 11 16 "Domestic Water Piping". Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Section 26 05 23 "Low-Voltage Electrical Power Conductors and Cables."
- D. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

### 3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following: Comply with requirements in Section 22 05 53 "Painting and Identification for Plumbing Piping and Equipment.

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
  - 1. Test each backflow preventer according to authorities having jurisdiction and the device's reference standard. All Reduced Pressure Zone backflow prevention devices shall be certified prior to issuance of the Plumbing Final Inspection.
  - 2. Test results shall be recorded on forms approved or provided by Louisa County.

- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

### 3.5 ADJUSTING

- A. Set field-adjustable flow set points of balancing valves.
- B. Set field-adjustable temperature set points of temperature-actuated water mixing valves.
- C. Adjust faces of thermometers and pressure gages to proper angle for best visibility.

END OF SECTION

SECTION 221316  
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Pipe, tube, and fittings.
- 2. Specialty pipe fittings.

- B. Related Sections:

- 1. Section 22 04 00 – General Requirements for Plumbing
- 2. Section 22 05 29 – Hanger and Supports for Plumbing Piping and Equipment
- 3. Section 22 05 53 – Painting and Identification for Plumbing Piping and Equipment
- 4. Section 22 07 00 – Plumbing Insulation
- 5. Section 22 13 19 – Sanitary Waste Piping Specialties

1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

- 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Comply with requirements in Division 01 and Section 22 04 00 "General Requirements for Plumbing".

- B. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

## 1.6 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
  - 1. Notify Architect and Owner no fewer than seven (7) days in advance of proposed interruption of sanitary waste service.
  - 2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

## PART 2 - PRODUCTS

### 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

### 2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following: AB&I Foundry, Charlotte Pipe & Foundry or Tyler Pipe. Cast iron pipe and fittings shall be manufactured in the USA bear the Collective Trademark of the Cast Iron Soil Pipe Institute.
- B. Pipe and Fittings: ASTM A 74, Service class.
- C. Gaskets: ASTM C 564, rubber.

### 2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following: AB&I Foundry, Charlotte Pipe & Foundry or Tyler Pipe. Cast Iron Pipe and fittings shall be manufactured in the USA and bear the Collective Trademark of the Cast Iron Soil Pipe Institute
- B. Pipe and Fittings: CISPI 301.
- C. CISPI, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ANACO Coupling.
    - b. Ideal Corporation.
    - c. Mission Rubber Company; a division of MCP Industries, Inc.

d. Tyler Pipe.

2. Standards: CISPI 310.

3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

## 2.4 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. Cellular-Core PVC Pipe: Cellular core pipe shall not be permitted.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.

1. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Solvent Cement: ASTM D 2564.

1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.

2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

3. Shielded, Non-pressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Cascade Waterworks Mfg. Co.

2) Mission Rubber Company; a division of MCP Industries, Inc.

b. Standard: ASTM C 1460.

- c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

## PART 3 - EXECUTION

### 3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- J. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 2 and smaller; 1 percent downward in direction of flow for piping NPS 3 and larger.
  2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- K. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- L. Install underground PVC piping according to ASTM D 2321.
- M. Plumbing Specialties:
1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts in Section 22 04 00 "General Requirements for Plumbing".
  2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains in Section 22 13 19 "Sanitary Waste Piping Specialties."
- N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves in Section 22 04 00 "General Requirements for Plumbing".
- P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons in Section 22 04 00 "General Requirements for Plumbing".

### 3.2 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Joints for hubless, cast-iron soil pipes and fittings shall conform to CISPI 310, latest revision and be certified by NSF for compliance to CISPI 310.
- C. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

### 3.3 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Shielded, non-pressure transition couplings.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
  1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  3. Vertical Piping: MSS Type 8 or Type 42, clamps.
  4. Install individual, straight, horizontal piping runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
  5. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  1. NPS 2: 60 inches with 3/8-inch rod.
  2. NPS 3: 60 inches with 1/2-inch rod.
  3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  4. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Support piping not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
  - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
  - 2. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - 3. Install test tees (wall cleanouts) in stacks near floor and floor cleanouts with cover flush with floor.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

### 3.6 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification in Section 22 05 53 "Painting and Identification for Plumbing Piping and Equipment."

### 3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to plumbing code:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Drainage and Vent Water Test: A water test shall be applied to the drainage system either in its entirety or in sections. If applied to the entire system, all openings in the piping shall be tightly closed, except the highest opening, and the system shall be filled with water to the point of overflow. If the system is tested in sections, each opening shall be tightly plugged except the highest openings of the section under test, and each section shall be filled with water, but no section shall be tested with less than 10-foot head of water. In testing successive sections, at least the upper 10 feet of the next preceding section shall be tested so that no joint or pipe in the building, except the uppermost 10 feet of the system, shall have been submitted to a test of less than 10-foot head of water. This pressure shall be held for at least 15 minutes. The system shall then be tight at all points.
  4. Drainage and Vent Air Test: An air test shall be made by forcing air into the system until there is a uniform gauge pressure of 5 psi or sufficient to balance a 10 inch column of mercury. This pressure shall be held for a test period of at least 15 minutes. Any adjustments to the test pressure required because of changes in ambient temperature or the seating of gaskets shall be made prior to the beginning of the test period. Plastic piping shall not be tested with air unless manufacturer literature states air testing is acceptable.
  5. Drainage and Vent Final Test: The final test of the completed drainage and vent system shall be visual and in sufficient detail to determine compliance with the provisions of the plumbing code except that the plumbing shall be subjected to a smoke test where necessary for cause. Where the smoke test is utilized, it shall be made by filling all traps with water and then introducing into the entire system a pungent, thick smoke produced by one or more smoke machines. When the smoke appears at stack openings on the roof, the stack openings shall be closed and pressure equivalent to a 1-inch water column shall be held for a test period of not less than 15 minutes.
  6. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  7. Prepare reports for tests and required corrective action.
- E. Clean interior of piping. Remove dirt and debris as work progresses.
- F. Place plugs in ends of uncompleted piping at end of day and when work stops.

### 3.8 PIPING SCHEDULE

- A. Aboveground, soil waste and vent piping shall be the following:
1. Hubless, cast-iron soil pipe and fittings CISPI, hubless-piping couplings; and coupled joints.
  2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- B. Underground, soil, waste, and vent piping shall be the following:

1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION

SECTION 221319  
SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:

- 1. Cleanouts.
- 2. Floor Drains
- 3. Miscellaneous sanitary drainage piping specialties.

- B. Related Sections:

- 1. Section 22 04 00 – General Requirements for Plumbing
- 2. Section 22 05 29 – Hanger and Supports for Plumbing Piping and Equipment
- 3. Section 22 05 53 – Painting and Identification for Plumbing Piping and Equipment
- 4. Section 22 07 00 – Plumbing Insulation
- 5. Section 22 11 16 – Domestic Water Piping
- 6. Section 22 11 19 – Domestic Water Piping Specialties
- 7. Section 22 13 16 – Sanitary Waste and Vent Piping

1.3 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Comply with requirements in Division 01 and Section 22 04 00 "General Requirements for Plumbing":
- B. Field quality-control test reports.
- C. Operation and Maintenance Data: For drainage piping specialties indicated [O/M], to include in emergency, operation, and maintenance manuals. Comply with

requirements in Division 01 and Section 22 04 00 "General Requirements for Plumbing".

#### 1.5 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

#### 1.6 COORDINATION

- A. Coordinate size and location of roof penetrations.

### PART 2 - PRODUCTS

#### 2.1 CLEANOUTS

- A. Floor Cleanouts:
  - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but not limited to the following:
    - a. Interior Finished Areas: Josam 57000-22, Jay R. Smith, 4033L, Zurn ZN-1400, Nickel bronze top.
    - b. Interior Equipment Rooms and Concrete Floors of Unfinished Areas on Grade: Josam 57000-X-CI-22, Jay R. Smith 4231, Zurn Z-1400 HD cast iron frame and cover.
  - 2. Standard: ASME A112.36.2M
  - 3. Size: Same as connected branch or as indicated on the Drawing.
  - 4. Type: Adjustable housing
  - 5. Body or Ferrule Material: Cast iron.
  - 6. Clamping Device: Not required.
  - 7. Outlet Connection: Soil Pipe Gasket.
  - 8. Closure: Brass plug with tapered threads.

9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy, Painted cast iron or Polished bronze.
11. Frame and Cover Shape: Round.
12. Top-Loading Classification: Heavy Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
14. Provide proper flanges for units with fluid applied floors.

B. Base of Exposed Vertical Stacks Near Floor:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Josam 48910, Jay R. Smith 4505Y, Wade 8560E, Zurn Z-1445.
2. Standard: ASME A112.36.2M and ASTM A74, ASTM A888, or CISPI 301, for cleanout test tees.
3. Size: Same as connected drainage piping.
4. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or hubless, cast-iron soil-pipe test tee as required to match connected piping.
5. Closure Plug: Countersunk, brass.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

C. Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but not limited to, the following:
  - a. Painted Drywall and Finished Masonry Walls: Josam 58600-PLG, Jay R. Smith 4472, Zurn Z-1468.
2. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
3. Size: Same as connected drainage piping.
4. Body Material: Hubless, cast-iron soil-pipe test tee as required to match connected piping.
5. Closure: Countersunk, drilled-and-threaded, brass plug.

6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

D. Outside Cleanouts:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Josam 55000-X-22, Jay R. Smith 4233, Wade 6000-NH-X, Zurn Z-1400 NH.
2. Standard: ASME A112.36.2M.
3. Size: Same as branch or as indicated on Drawings.
4. Type: Adjustable Housing
5. Body Material: Cast Iron.
6. Closure Plug Size: Brass with taper threads
7. Frame and Cover: Round Cast Iron
8. Top loading Classification: Heavy Duty.
9. Outlet: No-Hub or spigot.

## 2.2 FLOOR DRAINS

A. General Requirements: Drains are listed to generally describe type and features and shall be modified and furnished as required herein, suitable for construction conditions.

1. Drains shall have one-piece bodies or the Contractor shall effectively seal drain bodies to prevent leakage from two-piece body drains.
2. Strainers shall be ¼" thick, or equivalent, nickel bronze in finished rooms and spaces.
3. Strainer sizes shall be 8" for 4" drains unless otherwise noted.
4. Provide flashing clamps for all floors with water-proofing membranes.
5. Drain body shall be tapped for trap primer on floor drains equipped with trap primers.
6. Provide proper flanges for all units with fluid applied floors.

B. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to drain schedule on plans.
2. Standard: ASME A112.6.3.
3. Body Material: Gray iron.
4. Outlet: Bottom, caulk or soil pipe gasket.
5. Backwater Valve: As specified
6. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
7. Sediment Bucket: As specified.
8. Top or Strainer Material: Nickel bronze, Aluminum
9. Top Shape: As specified.
10. Trap Material: Cast iron or PVC.
11. Trap Pattern: Standard P-trap.

## 2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

### A. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

## 2.4 ROOF FLASHING ASSEMBLIES

### A. Comply with requirements for roof flashing specified in Division 07.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with requirements in other Division 22 Sections for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor. Cleanouts on 6" and smaller pipes shall be provided a minimum clearance of 18" for rodding. Cleanouts on 8" and larger pipes shall be provided a minimum clearance of 36" for rodding.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  1. Position floor drains for easy access and maintenance.
  2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
- F. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping
  1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
  2. Size: Same as floor drain inlet.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

### 3.3 PROTECTION

- A. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 230000  
BASIC HVAC REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes Basic Mechanical Requirements applicable to all Division 23 Sections.

1.2 REQUIREMENTS FOR THIS PROJECT

- A. Contractor shall be familiar with the required Codes as required to perform the Work.
- B. Contractor shall be familiar with Owner's requirements.

1.3 PRODUCTS

- A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.

1.4 MANUFACTURER INSTALLATION INSTRUCTIONS

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

1.5 MANUFACTURER CERTIFICATES

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

1.6 REGULATORY REQUIREMENTS

- A. Conform to:
  - 1. The Virginia Uniform Statewide Building Code (VUSBC) including referenced codes and standards.
  - 2. Industry Standards, Codes and Specifications:
    - a. ANSI: American National Standards Institute.
    - b. ARI: Air-Conditioning and Refrigeration Institute.

- c. ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers.
- d. ASME: American Society of Mechanical Engineers.
- e. ASTM: American Society for Testing and Materials.
- f. AWS: American Welding Society.
- g. AWWA: American Water Works Association.
- h. CISPI: Cast Iron Soil Pipe Institute.
- i. ICC: International Code Council, Inc.
- j. MSS: Manufacturers Standardization Society of the Valve & Fittings Industry, Inc.
- k. NAIMA: North American Insulation Manufacturers Association.
- l. NBS: National Bureau of Standards.
- m. NFPA: National Fire Protection Association.
- n. SMACNA: Sheet Metal and Air Conditioning Contractors.
- o. UL: Underwriters Laboratories, Inc.
- p. USASI: United States of America Standards Institute.
- q. VDOT: Virginia Department of Transportation.

- B. Obtain permits and request inspections from authority having jurisdiction.

## 1.7 PROJECT/SITE CONDITIONS

- A. Install work in locations shown on drawings, unless prevented by project conditions. The drawings show the general arrangement of all piping, ductwork, equipment and appurtenances and shall be followed as closely as actual building construction and the work of other trades will permit. The work shall conform to the requirements shown on all of the drawings. Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange the work accordingly, providing such fittings, valves, offsets, transitions and other accessories as may be required to meet such conditions.
- B. Prepare drawings showing proposed re-arrangement of work to meet project conditions, including changes to work specified in other Sections. Obtain permission of Architect/Engineer before proceeding.

## 1.8 PAINTING

- A. HVAC equipment, related piping, ductwork and materials do not require painting except as indicated below:
  - 1. Painting is not required for equipment having a factory applied finish except touch-up with matching finish where factory finish is damaged.
  - 2. Piping (except insulated and jacketed piping), fabricated supports, and any unfinished or unprotected materials located outdoors shall be painted with a suitable primer and compatible finish paint. Color shall be as directed by Architect/Engineer.
  - 3. Paint inside of ductwork with matte black paint where visible behind air inlets and outlets.

- B. Protection of work: Painting shall be done with care to protect work and work of other trades. All damage caused by the painting operations shall be corrected, repaired and cleaned as required. Hardware, special control items, gages, thermometers, nameplates, instrument glass and other similar items shall be removed or properly protected during the painting operation to ensure that these items are not covered or splattered with paint.

## 1.9 ELECTRICAL PROVISIONS

- A. Low voltage (less than 100 volts) control wiring and connections for equipment specified in Division 23 shall be provided per Division 23.
- B. All line voltage (100 volts and greater) field control wiring and connections for equipment furnished per Division 23, and all power wiring, and all related electric supply and disconnecting equipment and wiring shall be provided per Division 26.
- C. Line voltage field wiring for equipment furnished under Division 23 shall be accomplished under the supervision of the Division 26 subcontractor.

## 1.10 WARRANTY

- A. All materials and workmanship shall be warranted to be free from defects for a minimum period of one (1) year from date of acceptance and Contractor shall make good, without additional cost to the Owner, any defects which may appear within that period. Manufacturer's warranties extending beyond one year shall be processed and turned over to the Owner.
- B. Refer to specific specification sections for additional warranty requirements.

## 1.11 CLOSEOUT PROCEDURES: OPERATION AND MAINTENANCE MANUALS

- A. Comply with requirements of Division 1 Sections and the following requirements.
- B. Submit data on 8-1/2 x 11-inch pages in a digital format using "pdf" type files.
- C. Prepare cover sheet with printed title "Operation and Maintenance Instructions", title or project, and subject matter of binder when multiple binders are required.
- D. Internally subdivide the binder contents with permanent page dividers, logically organized, with minimum content as described below.
- E. Contents:
  - 1. Name of manufacturer.
  - 2. Name, address and telephone number of nearest manufacturer's representative.
  - 3. Copy of latest approved submittal including all review comments.
  - 4. Manufacturer's installation, operation and maintenance instructions including lubrication data.
  - 5. Parts numbers for all replaceable items.
  - 6. Serial numbers of all principal items of equipment.

- 7. Control diagrams and sequence of operation.
- 8. Manufacturer's written warranties that extend beyond the Contractor's one year warranty.
- F. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect/Engineer will return copy with comments.
- G. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect/Engineer [ and Commissioning Authority] will comment on whether general scope and content of manual are acceptable. Revise content of all document sets as required prior to final submittal.
- H. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect/Engineer will return copy with comments.

## PART 2 PRODUCTS

### 2.1 EQUIPMENT AND MATERIALS

- A. Dimensions: The Contractor shall verify that items to be furnished fit the space available. He shall make field measurements to ascertain space requirements, including those for connections and maintenance, and shall furnish and install such sizes and shapes of equipment that the final installation shall suit the true intent and meaning of the drawings and specifications. Should he conclude that there is insufficient space for installation of specified materials, he shall immediately notify the Architect/Engineer of the conflict and shall stop affected work until he receives instructions as to how to proceed from the Architect/Engineer.
- B. When substitution of equipment or materials requires changes or revisions to the arrangement, layout or design of any system, drawings showing these changes or revisions shall be submitted for review, along with other required submittal data. The costs of all such changes and revisions shall be borne by the Contractor.
- C. Similar items shall be provided by a single manufacturer.

### 2.2 EQUIPMENT ACCESSORIES

- A. The Contractor shall furnish and install all equipment, accessories, connections and incidental items necessary to fully complete the work ready for use, occupancy and operation by the Owner.
- B. Equipment or Connections Different from those Shown: Where equipment requiring different arrangement of connections from those shown is proposed by the Contractor, and is acceptable to the Architect/Engineer, it shall be the responsibility of the Contractor to install the equipment to operate properly and in

harmony with the intent of the drawings and specifications. The Contractor shall make all incidental changes in piping, ductwork, supports, insulation, heaters, controls and other associated facilities. He shall provide all additional equipment required for proper operation of the system, including all required changes in affected trades. The Contractor shall be responsible for the proper location of rough-in and connections. All such changes shall be made at no increase in cost to the Owner.

- C. Drives and Belt Guards: The Contractor shall provide for each chain or belt drive, rotating shaft, coupling or other moving parts, a protective guard which shall be securely bolted to the equipment base or apparatus. The guard shall completely enclose all moving parts and be constructed to comply with all safety requirements. For double inlet fans, the belt guard shall be arranged so as not to restrict the air flow into the fan inlet. Guards shall not interfere with lubrication of equipment.
- D. Supports: The Contractor shall support plumb, rigid and true to line all work and equipment furnished. The Contractor shall study thoroughly all general, structural and HVAC (mechanical) drawings, shop drawings and catalog data to determine how equipment, fixtures, piping, ductwork, etc., are to be supported, mounted or suspended and shall provide extra steel bolts, inserts, pipe stands, brackets and accessories for proper support whether or not shown on the drawings. When directed, the Contractor shall submit drawings showing supports for review by the Architect/Engineer.

## 2.3 ACCESS DOORS

- A. General: Access doors shall be provided for all concealed valves, controls, dampers, damper operators and any other equipment or material requiring inspection or maintenance. Access doors shall be furnished for floors, walls, and ceilings, or adequate size so that the concealed items will be readily accessible for servicing or for removal and replacement if necessary.

## PART 3 EXECUTION

### 3.1 INSTALLATION OF EQUIPMENT

- A. All equipment and materials specified in this Division shall be installed in accordance with the manufacturer's instructions including, but not limited to, the following:
  - 1. Storage, handling, rigging, and installation shall be accomplished using means and methods recommended by the manufacturer.
  - 2. Location and orientation of equipment shall provide the indicated operation and performance and shall also provide the recommended unobstructed clearances around equipment for maintenance and repair.
  - 3. Provide accessories and incidental materials recommended by the manufacturer.

### 3.2 COORDINATION

- A. Offsets, transitions and changes in direction in pipes and ducts shall be made as required to maintain proper head room, clearances and pitch of sloping lines whether or not indicated on the drawings. The Contractor shall furnish and install all fittings, traps, drains, air vents, etc., as required to effect these offsets, transitions and changes in direction.
- B. Ductwork: Exact arrangement and routing of ductwork shall be determined at the job site prior to beginning fabrication of any ductwork. The Contractor shall provide offsets and transitions, and change the cross-sectional dimensions of ductwork when required to meet job conditions but shall maintain at least the same equivalent cross-sectional area. The Contractor shall secure the approval of the Architect/Engineer prior to fabrication of ductwork requiring such changes.
- C. Drawings by the Contractor: When directed by the Architect/Engineer, the Contractor shall submit for review drawings clearly showing certain portions of the HVAC work and the relation to the work of other trades before commencing shop fabrication or erection at the project site.

### 3.3 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to project site identified with names, model numbers, types, grades, compliance labels, and other information needed for distinct identification; adequately packaged and protected to prevent damage during shipment, storage and handling. Protect stored equipment and materials from damage. Comply with manufacturer's rigging and moving instructions for unloading equipment and moving into final location.

### 3.4 INSTALLATION OF ACCESS DOORS

- A. Install access doors at all concealed valves, controls, dampers, damper operators, other equipment or materials requiring inspection or maintenance, where indicated and where required by Code, in accordance with manufacturer's written instructions and in compliance with industry practices.
- B. Coordinate with other work, including substrate construction work, as necessary to interface installation of access doors with other work.
- C. Locate each access door accurately in relation to the item requiring access.

### 3.5 DEMOLITION

- A. HVAC work necessary for demolition and renovation in the existing building shall be provided under this section.
- B. Work necessary to be performed in, or otherwise affecting the use or comfort of the remaining existing building, shall be coordinated with the occupants' schedule.

END OF SECTION

SECTION 230130.52  
EXISTING HVAC AIR DISTRIBUTION SYSTEM CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SPECIAL REQUIREMENTS FOR THIS PROJECT

- A. Provide duct cleaning for existing supply air and return air ductwork systems.
- B. Exhaust ductwork is not required to be cleaned.

1.3 SUMMARY

- A. Section includes cleaning existing HVAC air-distribution equipment, ducts, plenums, and system components.
- B. Related Requirements:
  - 1. Section 233113.00 "Metal Ducts" for cleaning newly installed metal ducts.
  - 2. Section 233300.00 "Air Duct Accessories" for restoration of opened ducts and plenums with access doors.

1.4 DEFINITIONS

- A. ACAC: American Council for Accredited Certification.
- B. AIHA-LAP: American Industrial Hygiene Association Lab Accreditation Program
- C. ASCS: Air systems cleaning specialist.
- D. CESB: Council of Engineering and Scientific Specialty Boards.
- E. IEP: Indoor Environmental Professional.
- F. IICRC: Institute of Inspection, Cleaning, and Restoration Certification.
- G. NADCA: National Air Duct Cleaners Association.

## 1.5 INFORMATIONAL SUBMITTALS

### A. Qualification Data:

1. For an ASCS.

## 1.6 CLOSEOUT SUBMITTALS

### A. Post-Project report.

## 1.7 QUALITY ASSURANCE

### A. ASCS Qualifications: A certified member of NADCA .

1. Certification: Employ an ASCS certified by NADCA on a full-time basis .
2. Supervisor Qualifications: Certified as an ASCS by NADCA .

## PART 2 - PRODUCTS

## 2.1 HVAC CLEANING AGENTS

### A. Description:

1. Formulated for each specific soiled coil condition that needs remedy.
2. Will not corrode or tarnish aluminum, copper, or other metals.

## PART 3 - EXECUTION

## 3.1 PREPARATION

- A. Inspect HVAC air-distribution equipment, ducts, plenums, and system components to determine appropriate methods, tools, and equipment required for performance of the Work.
- B. Perform "Project Evaluation and Recommendation" according to NADCA ACR.
- C. Cleaning Plan: Prepare a written plan for air-distribution system cleaning that includes strategies and step-by-step procedures. At a minimum, include the following:
  1. Supervisor contact information.
  2. Work schedule, including location, times, and impact on occupied areas.
  3. Methods and materials planned for each HVAC component type.
  4. Required support from other trades.
  5. Equipment and material storage requirements.
  6. Exhaust equipment setup locations.

- D. Existing Conditions Report: Prepare a written report that documents existing conditions of the systems and equipment. Include documentation of existing conditions, including inspection results, photo images, laboratory results, and interpretations of the laboratory results by an IEP.
  - 1. Prepare written report listing conditions detrimental to performance of the Work.
- E. Proceed with work only after conditions detrimental to performance of the Work have been corrected.
- F. Use the existing service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry and for inspection.
- G. Comply with NADCA ACR, "Guidelines for Constructing Service Openings in HVAC Systems" Section.
- H. Mark the position of manual volume dampers and air-directional mechanical devices inside the system prior to cleaning.

### 3.2 CLEANING

- A. Comply with NADCA ACR, including items identified as "recommended," "advised," and "suggested."
- B. Perform electrical lockout and tagout according to Owner's standards or authorities having jurisdiction.
- C. Remove non-adhered substances and deposits from within the HVAC system.
- D. Complete cleaning in accordance with Owner-Contractor agreed-upon scope of work.
- E. Systems and Components to Be Cleaned:
  - 1. Ductwork:
    - a. Supply-air ducts, including turning vanes and reheat coils, to the air-handling unit.
    - b. Return-air ducts to the air-handling unit.
    - c. Transfer ducts.
    - d. Exhaust ducts.
- F. Collect debris removed during cleaning. Ensure that debris is not dispersed outside the HVAC system during the cleaning process.
- G. Particulate Collection:
  - 1. For particulate collection equipment, include adequate filtration to contain debris removed. Locate equipment downwind and away from all air intakes and other points of entry into the building.
  - 2. HEPA filtration with 99.97 percent collection efficiency for particles sized 0.3 micrometer or larger shall be used where the particulate collection equipment is exhausting inside the building,

- H. Control odors and mist vapors during the cleaning and restoration process.
- I. Mark the position of manual volume dampers and air-directional mechanical devices inside the system prior to cleaning. Restore them to their marked position on completion of cleaning.
- J. System components shall be cleaned so that all HVAC system components are visibly clean. On completion, all components must be returned to those settings recorded just prior to cleaning operations.
- K. Air-Distribution Systems:
  - 1. Create service openings in the HVAC system as necessary to accommodate cleaning.
  - 2. Mechanically clean air-distribution systems specified to remove all visible contaminants, so that the systems are capable of passing the HVAC System Cleanliness Tests (see NADCA ACR).
- L. Debris removed from the HVAC system shall be disposed of according to applicable Federal, state, and local requirements.
- M. Mechanical Cleaning Methodology:
  - 1. Source-Removal Cleaning Methods: The HVAC system shall be cleaned using source-removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and to safely remove these contaminants from the facility. No cleaning method, or combination of methods, shall be used that could potentially damage components of the HVAC system or negatively alter the integrity of the system.
    - a. Use continuously operating vacuum-collection devices to keep each section being cleaned under negative pressure.
    - b. Cleaning methods that require mechanical agitation devices to dislodge debris that is adhered to interior surfaces of HVAC system components shall be equipped to safely remove these devices. Cleaning methods shall not damage the integrity of HVAC system components or damage porous surface materials, such as duct and plenum liners.
  - 2. Cleaning Mineral-Fiber Insulation Components:
    - a. Fibrous-glass thermal or acoustical insulation elements present in equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment while the HVAC system is under constant negative pressure and shall not be permitted to get wet according to NADCA ACR.
    - b. Cleaning methods used shall not cause damage to fibrous-glass components and will render the system capable of passing the HVAC System Cleanliness Tests (see NADCA ACR).
    - c. Fibrous materials that become wet shall be discarded and replaced.

### 3.3 CLEANLINESS VERIFICATION

- A. Verify cleanliness according to NADCA ACR, "Verification of HVAC System Cleanliness" Section.

- B. Verify HVAC system cleanliness after mechanical cleaning and before applying any treatment or introducing any treatment-related substance to the HVAC system, including biocidal agents and coatings.
- C. Surface-Cleaning Verification: Perform visual inspection for cleanliness. If no contaminants are evident through visual inspection, the HVAC system shall be considered clean. If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.
- D. Prepare a written cleanliness verification report. At a minimum, include the following:
  - 1. Written documentation of the success of the cleaning.
  - 2. Site inspection reports, initialed by supervisor, including notation on areas of inspection, as verified through visual inspection.
  - 3. Surface comparison test results if required.
  - 4. System areas found to be damaged.

### 3.4 RESTORATION

- A. Restore and repair HVAC air-distribution equipment, ducts, plenums, and components according to NADCA ACR, "Restoration and Repair of Mechanical Systems" Section.
- B. Restore service openings capable of future reopening. Comply with requirements in Section 233113 "Metal Ducts ."
- C. Replace fibrous-glass materials that cannot be restored by cleaning or resurfacing. Comply with requirements in Section 233113 "Metal Ducts" and Section 233116 "Nonmetal Ducts."
- D. Replace damaged insulation according to Section 230713 "Duct Insulation."
- E. Ensure that closures do not hinder or alter airflow.
- F. New closure materials, including insulation, shall match opened materials and shall have removable closure panels fitted with gaskets and fasteners.

### 3.5 PROJECT CLOSEOUT

- A. Post-Project Report:
  - 1. Post-cleaning photo images.
  - 2. Post-cleaning verification summary.

END OF SECTION

SECTION 230517  
SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves without waterstop.
2. Grout.
3. Silicone sealants.
4. Firestopping

1.2 ADDITIONAL NOTES FOR THIS PROJECT

- A. Use of PVC sleeves is not allowed in return air plenums.

1.3 ACTION SUBMITTALS

PART 2 - PRODUCTS

2.1 SLEEVES WITHOUT WATERSTOP

- A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends.
- B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, hot-dip galvanized, with plain ends.

2.2 GROUT

- A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000 psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## 2.3 SILICONE SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant.
  - 1. Standard: ASTM C920, Type S, Grade NS, Class 25, Use NT.
- B. Silicone, S, P, T, NT: Single-component, 25 , pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant.
  - 1. Standard: ASTM C920, Type S, Grade P, Class 25 , Uses T and NT.
- C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

## 2.4 FIRESTOPPING

- A. **Refer to specification section 078413, "Penetration Firestopping" for requirements related to piping penetrations through rated walls and partitions. All piping penetrations through rated walls shall be compliant with specification section 078413, "Penetration Firestopping".**

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF SLEEVES - GENERAL

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
  - 2. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.

2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use sealants appropriate for size, depth, and location of joint.

### 3.2 INSTALLATION OF SLEEVE-SEAL SYSTEMS

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building, and passing through exterior walls.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal-system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.3 SLEEVE SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  1. Interior Walls and Partitions:
    - a. Sleeves without waterstops.

END OF SECTION

SECTION 230519  
METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Thermowells.
  - 2. Dial-type pressure gages.
  - 3. Gage attachments.
  - 4. Test plugs.
  - 5. Test-plug kits.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
  - 1. Standard: ASME B40.200.
  - 2. Case: Cast aluminum ; 6-inch nominal size.
  - 3. Case Form: Back angle unless otherwise indicated.
  - 4. Tube: Glass with magnifying lens and blue or red organic liquid.
  - 5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F .
  - 6. Window: Glass or plastic.
  - 7. Stem: Aluminum or brass and of length to suit installation.
    - a. Design for Air-Duct Installation: With ventilated shroud.

- b. Design for Thermowell Installation: Bare stem.
- 8. Connector: 3/4 inch, with ASME B1.1 screw threads.
- 9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

## 2.2 THERMOWELLS

### A. Thermowells:

- 1. Standard: ASME B40.200.
- 2. Description: Pressure-tight, socket-type fitting made for insertion in piping tee fitting.
- 3. Material for Use with Copper Tubing: CNR or CUNI .
- 4. Material for Use with Steel Piping: CRES .
- 5. Type: Stepped shank unless straight or tapered shank is indicated.
- 6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
- 7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
- 8. Bore: Diameter required to match thermometer bulb or stem.
- 9. Insertion Length: Length required to match thermometer bulb or stem.
- 10. Lagging Extension: Include on thermowells for insulated piping and tubing.
- 11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

### B. Heat-Transfer Medium: Mixture of graphite and glycerin .

## 2.3 DIAL-TYPE PRESSURE GAGES

### A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

- 1. Standard: ASME B40.100.
- 2. Case: Liquid-filled Sealed Solid-front, pressure relief type(s); cast aluminum or drawn steel ; 4-1/2-inch nominal diameter.
- 3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
- 4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 , ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
- 5. Movement: Mechanical, with link to pressure element and connection to pointer.

6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi .
7. Pointer: Dark-colored metal.
8. Window: Glass .
9. Ring: Metal .
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

## 2.4 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2 , ASME B1.20.1 pipe threads and piston -type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: , with NPS 1/4 or NPS 1/2 , ASME B1.20.1 pipe threads.

## 2.5 TEST PLUGS

- A. Description: Test-station fitting made for insertion in piping tee fitting.
- B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- C. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.
- D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F .
- E. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

- G. Install remote-mounted pressure gages on panel.
- H. Install valve and snubber in piping for each pressure gage for fluids (except steam).
- I. Install test plugs in piping tees.
- J. Install flow indicators in piping systems in accessible positions for easy viewing.
- K. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.
- L. Install permanent indicators on walls or brackets in accessible and readable positions.
- M. Install connection fittings in accessible locations for attachment to portable indicators.
- N. Install thermometers in the following locations:
  - 1. At inlet and outlet of all air handling unit coils and where indicated on Drawings.
- O. Install pressure gages in the following locations:
  - 1. Where indicated on Drawings.

### 3.2 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow space for service and maintenance of meters, gages, machines, and equipment.

### 3.3 ADJUSTING

- A. After installation, calibrate meters according to manufacturer's written instructions.
- B. Adjust faces of meters and gages to proper angle for best visibility.

### 3.4 PRESSURE-GAGE SCHEDULE

- A. Pressure gages at inlet and outlet of each chiller chilled-water and condenser-water connection shall be one of the following:
  - 1. Liquid-filled Sealed Solid-front, pressure-relief , direct -mounted, metal case.
  - 2. Sealed , direct -mounted, plastic case.
  - 3. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- B. Pressure gages at suction and discharge of each pump shall be one of the following:
  - 1. Liquid-filled Sealed Solid-front, pressure-relief , direct -mounted, metal case.
  - 2. Sealed , direct -mounted, plastic case.
  - 3. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Chilled-Water Piping: 0 to 100 psi .
- B. Scale Range for Heating, Hot-Water Piping: 0 to 100 psi .

END OF SECTION

SECTION 230523.12  
BALL VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Brass ball valves.
  - 2. Bronze ball valves.

1.2 DEFINITIONS

- A. CWP: Cold working pressure.
- B. RPTFE: Reinforced polytetrafluoroethylene.
- C. SWP: Steam working pressure.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, and weld ends.
  - 3. Set ball valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
  2. ASME B16.1 for flanges on iron valves.
  3. ASME B16.5 for flanges on steel valves.
  4. ASME B16.34 for flanged and threaded end connections.
  5. ASME B31.9 for building services piping valves.
- B. Provide bronze valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
1. Hand Lever: For quarter-turn valves smaller than NPS 4 .
- E. Valves in Insulated Piping:
1. Provide 2-inch extended neck stems.
  2. Extended operating handles with nonthermal-conductive covering material, and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
  3. Memory stops that are fully adjustable after insulation is applied.
- F. Valve Bypass and Drain Connections: MSS SP-45.
- ## 2.2 BRASS BALL VALVES
- A. Brass Ball Valves, Two Piece with Full Port and Brass Trim, Threaded or Soldered Ends:
1. Standard: MSS SP-110.
  2. SWP Rating: 150 psig.
  3. CWP Rating: 600 psig.
  4. Body Design: Two piece.
  5. Body Material: Forged brass.
  6. Ends: Threaded or soldered.
  7. Seats: PTFE.
  8. Stem: Brass.

9. Ball: Chrome-plated brass.

10. Port: Full.

## 2.3 BRONZE BALL VALVES

A. Bronze Ball Valves, Two Piece with Full Port and Bronze or Brass Trim, Threaded or Soldered Ends:

1. Standard: MSS SP-110.

2. SWP Rating: 150 psig.

3. CWP Rating: 600 psig.

4. Body Design: Two piece.

5. Body Material: Bronze.

6. Ends: Threaded or soldered.

7. Seats: PTFE.

8. Stem: Bronze.

9. Ball: Chrome-plated brass.

10. Port: Full.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves. Remove defective valves from site.

### 3.2 INSTALLATION OF VALVES

- A. Install valves with unions or flanges at each piece of equipment arranged to allow space for service, maintenance, and equipment removal without system shutdown.
- B. Provide support of piping adjacent to valves such that no force is imposed upon valves.
- C. Locate valves for easy access.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full valve actuation movement.
- F. Valve Tags: Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.
- G. Adhere to manufacturer's written installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve manufacturer's recommended maximum.

### 3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves exhibiting leakage.

### 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified SWP classes or CWP ratings are unavailable, provide the same types of valves with higher SWP classes or CWP ratings.
- B. Select valves with the following end connections:
  - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.
  - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  - 3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
  - 4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

### 3.5 HEATING-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller: Brass or bronze ball valves, two piece with brass bronze trim, full port, and threaded -joint ends.

END OF SECTION

SECTION 230523.14  
CHECK VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Bronze lift check valves.
  - 2. Bronze swing check valves.

1.2 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene-propylene-diene monomer.
- C. NBR: Nitrile butadiene rubber (also known as "Buna-N").
- D. SWP: Steam working pressure.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, press connections, and weld ends.
  - 3. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use stems or other components as lifting or rigging points unless specifically indicated for this purpose in manufacturer's written instructions.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

#### A. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for cast copper solder joint.
5. ASME B16.22 for wrought copper solder joint.
6. ASME B31.9 for building services piping valves.

#### B. Provide bronze valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are unacceptable.

#### C. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

#### D. Valve Sizes: Same as upstream piping unless otherwise indicated.

#### E. Valve Bypass and Drain Connections: MSS SP-45.

### 2.2 BRONZE SWING CHECK VALVES

#### A. Bronze Swing Check Valves with Bronze Disc, Class 125:

1. Description:
  - a. Standard: MSS SP-80, Type 3.
  - b. CWP Rating: 200 psig.
  - c. Body Design: Horizontal flow.
  - d. Body Material: ASTM B62, bronze.
  - e. Ends: Threaded.
  - f. Disc: Bronze.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Examine press fittings to verify they have been properly pressed.
- F. Do not attempt to repair defective valves; replace with new valves.

### 3.2 INSTALLATION OF VALVES

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Provide support of piping adjacent to valves such that no force is imposed upon valves.
- C. Locate valves for easy access and where not blocked by equipment, other piping, or building components.
- D. Install valves with stem at or above center of pipe.
- E. Install valves in position that does not project into aisles or block access to other equipment.
- F. Install valves in position to allow full stem and manual operator movement.
- G. Verify that joints of each valve have been properly installed and sealed to ensure that there is no leakage or damage.
- H. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.
  - 2. Lift Check Valves: With stem upright and plumb.
- I. Install valve tags. Comply with requirements for valve tags and schedules in Section 230553 "Identification for HVAC Piping and Equipment."

- J. Adhere to manufacturer's written installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve of manufacturer's recommended maximum.

### 3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves if persistent leaking occurs.

### 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- B. End Connections:
  - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends, except where solder-joint or press valve-end option is indicated in valve schedules.
  - 2. For Steel Piping, NPS 2 and Smaller: Threaded ends.

### 3.5 HEATING-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
  - 1. Bronze swing check valves with bronze disc, Class 125 .

END OF SECTION

SECTION 230529  
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Thermal-hanger shield inserts.
  - 5. Fastener systems.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
  - 3. Nonmetallic Coatings: Plastic coated, or epoxy powder-coated.
  - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel .
- B. Copper Pipe and Tube Hangers:
  - 1. Description: MSS SP-58, Types 1 through 58, copper-plated steel, factory-fabricated components.
  - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-plated steel .

## 2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

## 2.3 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psi or ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## 2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Indoor Applications: Zinc-coated or stainless steel.

## 2.5 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand:
  - 1. Description: Single base unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
  - 2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
  - 3. Hardware: Galvanized steel or polycarbonate.
  - 4. Accessories: Protection pads.

C. Low-Profile, Single Base, Single-Pipe Stand:

1. Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.
2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
3. Vertical Members: Two, galvanized -steel, continuous-thread 1/2-inch rods.
4. Horizontal Member: Adjustable horizontal, galvanized -steel pipe support channels.
5. Pipe Supports: Roller Strut clamps Clevis hanger Swivel hanger.
6. Hardware: Galvanized steel.
7. Accessories: Protection pads.

2.6 MATERIALS

- A. Carbon Steel: ASTM A1011/A1011M.
- B. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.
- C. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  1. Properties: Nonstaining, noncorrosive, and nongaseous.
  2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb .

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
  - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.
- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
  - 5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches .

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Section 099113 "Exterior Painting" Section 099123 "Interior Painting" and for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

### 3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper or stainless steel attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.

- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
  3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
  4. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
  6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  9. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
  10. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  11. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  12. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  13. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
  14. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
  15. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.

16. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
  17. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.
  18. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.
  19. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  7. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Heavy (MSS Type 33): 3000 lb.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 230553  
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Warning tape.
4. Pipe labels.
5. Valve tags.
6. Warning tags.

1.2 ADDITIONAL REQUIREMENTS FOR THIS PROJECT

- A. Provide labels for wall mounted thermostats and humidity sensors. Coordinate with DDC installation.
- B. Coordinate with Owner for numbering on valve tags. Field coordinate and photograph existing valve tags prior to demolition.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.
2. Letter and Background Color: As indicated for specific application under Part 3.
3. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately

larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

- 6. Fasteners: Stainless steel rivets or self-tapping screws.
- 7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

## 2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.
- B. Letter and Background Color: As indicated for specific application under Part 3.
- C. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
- D. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- E. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- F. Fasteners: Stainless steel rivets or self-taping screws.
- G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- H. Arc-Flash Warning Signs: Provide arc-flash warning signs in locations and with content in accordance with requirements of OSHA and NFPA70E.
- I. Label Content: Include caution and warning information plus emergency notification instructions.

## 2.3 WARNING TAPE

- A. Material: Vinyl.
- B. Minimum Thickness: 0.005 inch.
- C. Letter, Pattern, and Background Color: As indicated for specific application under Part 3.
- D. Waterproof Adhesive Backing: Suitable for indoor or outdoor use.
- E. Maximum Temperature: 160 deg F.

- F. Minimum Width: 4 inches.

## 2.4 VALVE TAGS

- A. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
  - 1. Tag Material: Brass, 0.04-inch minimum thickness, with predrilled or stamped holes for attachment hardware.
  - 2. Fasteners: Brass.
- B. Letter and Background Color: As indicated for specific application under Part 3.
- C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation, location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  - 1. Include valve-tag schedule in operation and maintenance data.

## 2.5 WARNING TAGS

- A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.
  - 1. Size: 3 by 5-1/4 inches minimum .
  - 2. Fasteners: Brass grommet and wire .
  - 3. Nomenclature: Large-size primary caption, such as "DANGER," "CAUTION," or "DO NOT OPERATE."
  - 4. Letter and Background Color: As indicated for specific application under Part 3.

# PART 3 - EXECUTION

## 3.1 PREPARATION

- A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

## 3.2 INSTALLATION, GENERAL REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Locate identifying devices so that they are readily visible from the point of normal approach.

### 3.3 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

- A. Permanently fasten labels on each item of mechanical equipment.
- B. Sign and Label Colors:
  - 1. White letters on an ANSI Z535.1 safety-blue background .
- C. Locate equipment labels where accessible and visible.

### 3.4 INSTALLATION OF WARNING TAPE

- A. Warning Tape Color and Pattern: Yellow background with black diagonal stripes .
- B. Install warning tape on pipes and ducts, with cross-designated walkways providing less than 6 ft. of clearance.
- C. Locate tape so as to be readily visible from the point of normal approach.

### 3.5 INSTALLATION OF VALVE TAGS

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule in the operating and maintenance manual.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below.
  - 1. Valve-Tag Size and Shape:
    - a. Chilled Water: 1-1/2 inches , round .
    - b. Hot Water: 1-1/2 inches , round .

### 3.6 INSTALLATION OF WARNING TAGS

- A. Warning Tag Color: Black letters on an ANSI Z535.1 safety-yellow background .
- B. Attach warning tags, with proper message, to equipment and other items where indicated on Drawings .

END OF SECTION

SECTION 230593  
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Testing, Adjusting, and Balancing of Air Systems:
    - a. Variable-air-volume systems.
  - 2. Testing, Adjusting, and Balancing of Hydronic Piping Systems:
    - a. Variable-flow hydronic systems.
  - 3. Testing, adjusting, and balancing of equipment.
  - 4. Duct leakage tests verification.
  - 5. HVAC-control system verification.

1.3 SPECIAL REQUIREMENTS FOR THIS PROJECT

- A. Provide duct testing for all EXISTING and NEW supply duct systems between the air handling unit and the VAV terminal units.
- B. Duct testing of low pressure supply ductwork downstream of the VAV terminal units is not required.
- C. Duct testing of existing exhaust ducts is not required.

1.4 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- F. TDH: Total dynamic head.

- G. UFAD: Underfloor air distribution.

## 1.5 PREINSTALLATION MEETINGS

- A. TAB Conference: Conduct a TAB conference at Project site or via conference call after approval of the TAB strategies and procedures plan, to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.
  - 1. Minimum Agenda Items:
    - a. The Contract Documents examination report.
    - b. The TAB plan.
    - c. Needs for coordination and cooperation of trades and subcontractors.
    - d. Proposed procedures for documentation and communication flow.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 90 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Strategies and Procedures Plan: Within 90 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures, as specified in "Preparation" Article.
- C. System Readiness Checklists: Within 90 days of Contractor's Notice to Proceed, submit system readiness checklists, as specified in "Preparation" Article.
- D. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- E. Certified TAB reports.
- F. Sample report forms.
- G. Instrument calibration reports, to include the following:
  - 1. Instrument type and make.
  - 2. Serial number.
  - 3. Application.
  - 4. Dates of use.
  - 5. Dates of calibration.

## 1.7 QUALITY ASSURANCE

- A. TAB Specialists Qualifications, Certified by AABC:
  - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
  - 2. TAB Technician: Employee of the TAB specialist and certified by AABC.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."
- D. Code and AHJ Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums used for HVAC to verify that they are properly separated from adjacent areas and sealed.
- F. Examine equipment performance data, including fan and pump curves.
  - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
  - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's

"HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine control valves for proper installation for their intended function of isolating, throttling, diverting, or mixing fluid flows.
- L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- M. Examine operating safety interlocks and controls on HVAC equipment.
- N. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.
- O. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### 3.2 PREPARATION

- A. Prepare a TAB plan that includes the following:
  - 1. Equipment and systems to be tested.
  - 2. Strategies and step-by-step procedures for balancing the systems.
  - 3. Instrumentation to be used.
  - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
  - 1. Airside:
    - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
    - b. Duct systems are complete with terminals installed.
    - c. Volume, smoke, and fire dampers are open and functional.

- d. Clean filters are installed.
  - e. Fans are operating, free of vibration, and rotating in correct direction.
  - f. Variable-frequency controllers' startup is complete and safeties are verified.
  - g. Automatic temperature-control systems are operational.
  - h. Ceilings are installed.
  - i. Suitable access to balancing devices and equipment is provided.
2. Hydronics:
- a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
  - b. Piping is complete with terminals installed.
  - c. Water treatment is complete.
  - d. Systems are flushed, filled, and air purged.
  - e. Strainers are pulled and cleaned.
  - f. Control valves are functioning in accordance with the sequence of operation.
  - g. Shutoff and balance valves have been verified to be 100 percent open.
  - h. Variable-frequency controllers' startup is complete and safeties are verified.
  - i. Suitable access to balancing devices and equipment is provided.

### 3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system in accordance with the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.
  - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
  - 3. Where holes for probes are required in piping or hydronic equipment, install pressure and temperature test plugs to seal systems.

4. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish in accordance with Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."
  - C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
  - D. Take and report testing and balancing measurements in inch-pound (IP) units.
- 3.4 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT
- A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:
    1. Motors.
    2. Fans and ventilators.
    3. Terminal units.
    4. Unit heaters.
    5. Air-handling units.
- 3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS
- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
  - B. Prepare schematic diagrams of systems' Record drawings duct layouts.
  - C. For variable-air-volume systems, develop a plan to simulate diversity.
  - D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
  - E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
  - F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
  - G. Verify that motor starters are equipped with properly sized thermal protection.
  - H. Check dampers for proper position to achieve desired airflow path.
  - I. Check for airflow blockages.
  - J. Check condensate drains for proper connections and functioning.

- K. Check for proper sealing of air-handling-unit components.

### 3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Adjust the variable-air-volume systems as follows:

1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.
2. Verify that the system is under static pressure control.
3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:
  - a. Adjust controls so that terminal is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.
  - b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
  - c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
  - d. Adjust controls so that terminal is calling for minimum airflow.
  - e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
  - f. On constant volume terminals, in critical areas where room pressure is to be maintained, verify that the airflow remains constant over the full range of full cooling to full heating. Note any deviation from design airflow or room pressure.
5. After terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.
  - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
  - b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow, so that connected total matches fan selection and simulates actual load in the building.

- c. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
  - d. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
- 6. Measure fan static pressures as follows:
  - a. Measure static pressure directly at the fan outlet or through the flexible connection.
  - b. Measure static pressure directly at the fan inlet or through the flexible connection.
  - c. Measure static pressure across each component that makes up the air-handling system.
  - d. Report any artificial loading of filters at the time static pressures are measured.
- 7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
  - a. Balance the return-air ducts and inlets.
  - b. Verify that terminal units are meeting design airflow under system maximum flow.
- 8. Re-measure the inlet static pressure at the most critical terminal unit, and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure. Record set point and give to controls Contractor.
- 9. Verify final system conditions as follows:
  - a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
  - b. Re-measure and confirm that total airflow is within design.
  - c. Re-measure final fan operating data, speed, volts, amps, and static profile.
  - d. Mark final settings.
  - e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
  - f. Verify tracking between supply and return fans.

### 3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports for pumps, coils, and other equipment. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and equipment flow rates with pump design flow rate.
- B. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:
  - 1. Locate start-stop and disconnect switches, electrical interlocks, and motor controllers.
  - 2. Verify that motor controllers are equipped with properly sized thermal protection.

### 3.8 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals, and proceed as specified above for hydronic systems.
- B. Adjust the variable-flow hydronic system as follows:
  - 1. Verify that the pressure-differential sensor(s) is located as indicated.
  - 2. Determine whether there is diversity in the system.
- C. For systems with no flow diversity:
  - 1. Adjust pumps to deliver total design flow.
    - a. Measure total water flow.
      - 1) Position valves for full flow through coils.
      - 2) Measure flow by main flow meter, if installed.
      - 3) If main flow meter is not installed, determine flow by pump TDH or known equipment pressure drop.
    - b. Measure pump TDH as follows:
      - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
      - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
      - 3) Convert pressure to head and correct for differences in gauge heights.

- 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.
    - 5) With valves open, read pump TDH. Adjust pump discharge valve or speed until design water flow is achieved. If excessive throttling is required to achieve desired flow, recommend pump impellers be trimmed to reduce excess throttling.
  - c. Monitor motor performance during procedures, and do not operate motor in an overloaded condition.
2. Adjust flow-measuring devices installed in mains and branches to design water flows.
  - a. Measure flow in main and branch pipes.
  - b. Adjust main and branch balance valves for design flow.
  - c. Re-measure each main and branch after all have been adjusted.
3. Adjust flow-measuring devices installed at terminals for each space to design water flows.
  - a. Measure flow at terminals.
  - b. Adjust each terminal to design flow.
  - c. Re-measure each terminal after it is adjusted.
  - d. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
  - e. Perform temperature tests after flows have been balanced.
4. For systems with pressure-independent valves at terminals:
  - a. Measure differential pressure and verify that it is within manufacturer's specified range.
  - b. Perform temperature tests after flows have been verified.
5. For systems without pressure-independent valves or flow-measuring devices at terminals:
  - a. Measure and balance coils by either coil pressure drop or temperature method.
  - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.

6. Prior to verifying final system conditions, determine the system pressure-differential set point(s).
  7. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion, open discharge valve 100 percent, and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
  8. Mark final settings and verify that all memory stops have been set.
  9. Verify final system conditions as follows:
    - a. Re-measure and confirm that total flow is within design.
    - b. Re-measure final pumps' operating data, TDH, volts, amps, speed, and static profile.
    - c. Mark final settings.
- D. For systems with flow diversity:
1. Determine diversity factor.
  2. Simulate system diversity by closing required number of control valves, as approved by Architect.
  3. Adjust pumps to deliver total design flow.
    - a. Measure total water flow.
      - 1) Position valves for full flow through coils.
      - 2) Measure flow by main flow meter, if installed.
      - 3) If main flow meter is not installed, determine flow by pump TDH or known equipment pressure drop.
    - b. Measure pump TDH as follows:
      - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
      - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
      - 3) Convert pressure to head and correct for differences in gauge heights.
      - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.

- 5) With valves open, read pump TDH. Adjust pump discharge valve or speed until design water flow is achieved. If excessive throttling is required to achieve desired flow, recommend pump impellers be trimmed to reduce excess throttling.
  - c. Monitor motor performance during procedures, and do not operate motor in an overloaded condition.
4. Adjust flow-measuring devices installed in mains and branches to design water flows.
  - a. Measure flow in main and branch pipes.
  - b. Adjust main and branch balance valves for design flow.
  - c. Re-measure each main and branch after all have been adjusted.
5. Adjust flow-measuring devices installed at terminals for each space to design water flows.
  - a. Measure flow at terminals.
  - b. Adjust each terminal to design flow.
  - c. Re-measure each terminal after it is adjusted.
  - d. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
  - e. Perform temperature tests after flows have been balanced.
6. For systems with pressure-independent valves at terminals:
  - a. Measure differential pressure, and verify that it is within manufacturer's specified range.
  - b. Perform temperature tests after flows have been verified.
7. For systems without pressure-independent valves or flow-measuring devices at terminals:
  - a. Measure and balance coils by either coil pressure drop or temperature method.
  - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
8. Open control valves that were shut. Close a sufficient number of control valves that were previously open to maintain diversity, and balance terminals that were just opened.

9. Prior to verifying final system conditions, determine system pressure-differential set point(s).
10. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion, open discharge valve 100 percent, and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
11. Mark final settings and verify that memory stops have been set.
12. Verify final system conditions as follows:
  - a. Re-measure and confirm that total water flow is within design.
  - b. Re-measure final pumps' operating data, TDH, volts, amps, speed, and static profile.
  - c. Mark final settings.

### 3.9 PROCEDURES FOR MOTORS

- A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
  1. Manufacturer's name, model number, and serial number.
  2. Motor horsepower rating.
  3. Motor rpm.
  4. Phase and hertz.
  5. Nameplate and measured voltage, each phase.
  6. Nameplate and measured amperage, each phase.
  7. Starter size and thermal-protection-element rating.
  8. Service factor and frame size.
- B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

### 3.10 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each hydronic coil:
  1. Entering- and leaving-water temperature.
  2. Water flow rate.
  3. Water pressure drop.

4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

B. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Entering and leaving refrigerant pressure and temperatures.

### 3.11 DUCT LEAKAGE TESTS

- A. Witness the duct leakage testing performed by Installer.
- B. Verify that proper test methods are used and that leakage rates are within specified limits.
- C. Report deficiencies observed.

### 3.12 HVAC CONTROLS VERIFICATION

- A. In conjunction with system balancing, perform the following:
  1. Verify HVAC control system is operating within the design limitations.
  2. Confirm that the sequences of operation are in compliance with Contract Documents.
  3. Verify that controllers are calibrated and function as intended.
  4. Verify that controller set points are as indicated.
  5. Verify the operation of lockout or interlock systems.
  6. Verify the operation of valve and damper actuators.
  7. Verify that controlled devices are properly installed and connected to correct controller.
  8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.

9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

- B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

### 3.13 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent . If design value is less than 100 cfm, within 10 cfm.
2. Air Outlets and Inlets: Plus or minus 10 percent . If design value is less than 100 cfm, within 10 cfm.
3. Heating-Water Flow Rate: Plus or minus 5 percent . If design value is less than 10 gpm, within 10 percent.
4. Chilled-Water Flow Rate: Plus or minus 5 percent . If design value is less than 10 gpm, within 10 percent.

- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

### 3.14 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for system-balancing devices. Recommend changes and additions to system-balancing devices, to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance-measuring and -balancing devices.
- B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

### 3.15 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
  1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  2. Include a list of instruments used for procedures, along with proof of calibration.
  3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
  2. Manufacturers' test data.
  3. Field test reports prepared by system and equipment installers.
  4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
  2. Name and address of the TAB specialist.
  3. Project name.
  4. Project location.
  5. Architect's name and address.
  6. Engineer's name and address.
  7. Contractor's name and address.
  8. Report date.
  9. Signature of TAB supervisor who certifies the report.
  10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  11. Summary of contents, including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  12. Nomenclature sheets for each item of equipment.
  13. Data for terminal units, including manufacturer's name, type, size, and fittings.
  14. Notes to explain why certain final data in the body of reports vary from indicated values.
  15. Test conditions for fans performance forms, including the following:
    - a. Settings for outdoor-, return-, and exhaust-air dampers.

- b. Conditions of filters.
  - c. Cooling coil, wet- and dry-bulb conditions.
  - d. Heating coil, dry-bulb conditions.
  - e. Face and bypass damper settings at coils.
  - f. Fan drive settings, including settings and percentage of maximum pitch diameter.
  - g. Variable-frequency controller settings for variable-air-volume systems.
  - h. Settings for pressure controller(s).
  - i. Other system operating conditions that affect performance.
16. Test conditions for pump performance forms, including the following:
- a. Variable-frequency controller settings for variable-flow hydronic systems.
  - b. Settings for pressure controller(s).
  - c. Other system operating conditions that affect performance.
- D. Air-Handling-Unit Test Reports: For air-handling units, include the following:
1. Unit Data:
- a. Unit identification.
  - b. Location.
  - c. Make and type.
  - d. Model number and unit size.
  - e. Manufacturer's serial number.
  - f. Unit arrangement and class.
  - g. Discharge arrangement.
  - h. Sheave make, size in inches, and bore.
  - i. Center-to-center dimensions of sheave and amount of adjustments in inches.
  - j. Number, make, and size of belts.
  - k. Number, type, and size of filters.

2. Motor Data:

- a. Motor make, and frame type and size.
- b. Horsepower and speed.
- c. Volts, phase, and hertz.
- d. Full-load amperage and service factor.
- e. Sheave make, size in inches, and bore.
- f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

- a. Total airflow rate in cfm.
- b. Total system static pressure in inches wg.
- c. Fan speed.
- d. Inlet and discharge static pressure in inches wg.
- e. For each filter bank, filter static-pressure differential in inches wg.
- f. Preheat-coil static-pressure differential in inches wg.
- g. Cooling-coil static-pressure differential in inches wg.
- h. Heating-coil static-pressure differential in inches wg.
- i. List for each internal component with pressure-drop, static-pressure differential in inches wg.
- j. Outdoor airflow in cfm.
- k. Return airflow in cfm.
- l. Outdoor-air damper position.
- m. Return-air damper position.

E. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
- b. Location.

- c. Coil type.
  - d. Number of rows.
  - e. Fin spacing in fins per inch o.c.
  - f. Make and model number.
  - g. Face area in sq. ft..
  - h. Tube size in NPS.
  - i. Tube and fin materials.
  - j. Circuiting arrangement.
2. Test Data (Indicated and Actual Values):
- a. Airflow rate in cfm.
  - b. Average face velocity in fpm.
  - c. Air pressure drop in inches wg.
  - d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
  - e. Return-air, wet- and dry-bulb temperatures in deg F.
  - f. Entering-air, wet- and dry-bulb temperatures in deg F.
  - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
  - h. Water flow rate in gpm.
  - i. Water pressure differential in feet of head or psig.
  - j. Entering-water temperature in deg F.
  - k. Leaving-water temperature in deg F.

F. Fan Test Reports: For supply, return, and exhaust fans, include the following:

- 1. Fan Data:
  - a. System identification.
  - b. Location.
  - c. Make and type.
  - d. Model number and size.

- e. Manufacturer's serial number.
  - f. Arrangement and class.
  - g. Sheave make, size in inches, and bore.
  - h. Center-to-center dimensions of sheave and amount of adjustments in inches.
2. Motor Data:
- a. Motor make, and frame type and size.
  - b. Horsepower and speed.
  - c. Volts, phase, and hertz.
  - d. Full-load amperage and service factor.
  - e. Sheave make, size in inches, and bore.
  - f. Center-to-center dimensions of sheave and amount of adjustments in inches.
  - g. Number, make, and size of belts.
3. Test Data (Indicated and Actual Values):
- a. Total airflow rate in cfm.
  - b. Total system static pressure in inches wg.
  - c. Fan speed.
  - d. Discharge static pressure in inches wg.
  - e. Suction static pressure in inches wg.
- G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
- a. System fan and air-handling-unit number.
  - b. Location and zone.
  - c. Traverse air temperature in deg F.
  - d. Duct static pressure in inches wg.
  - e. Duct size in inches.

- f. Duct area in sq. ft..
- g. Indicated airflow rate in cfm.
- h. Indicated velocity in fpm.
- i. Actual airflow rate in cfm.
- j. Actual average velocity in fpm.
- k. Barometric pressure in psig.

H. Air-Terminal-Device Reports:

1. Unit Data:

- a. System and air-handling unit identification.
- b. Location and zone.
- c. Apparatus used for test.
- d. Area served.
- e. Make.
- f. Number from system diagram.
- g. Type and model number.
- h. Size.
- i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm.
- b. Air velocity in fpm.
- c. Preliminary airflow rate as needed in cfm.
- d. Preliminary velocity as needed in fpm.
- e. Final airflow rate in cfm.
- f. Final velocity in fpm.
- g. Space temperature in deg F.

I. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:
  - a. System and air-handling-unit identification.
  - b. Location and zone.
  - c. Room or riser served.
  - d. Coil make and size.
  - e. Flowmeter type.
2. Test Data (Indicated and Actual Values):
  - a. Airflow rate in cfm.
  - b. Entering-water temperature in deg F.
  - c. Leaving-water temperature in deg F.
  - d. Water pressure drop in feet of head or psig.
  - e. Entering-air temperature in deg F.
  - f. Leaving-air temperature in deg F.

J. Instrument Calibration Reports:

1. Report Data:
  - a. Instrument type and make.
  - b. Serial number.
  - c. Application.
  - d. Dates of use.
  - e. Dates of calibration.

3.16 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Commissioning Authority.
- B. Commissioning Authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to the lesser of either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day .

- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the TAB shall be considered incomplete and shall be rejected.
- E. If recheck measurements find the number of failed measurements noncompliant with requirements indicated, proceed as follows:
  - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection. All changes shall be tracked to show changes made to previous report.
  - 2. If the second final inspection also fails, Owner may pursue others Contract options to complete TAB work.
- F. Prepare test and inspection reports.

END OF SECTION

SECTION 230713  
DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following duct services:
  - 1. Indoor, concealed supply and outdoor air.
  - 2. Indoor, exposed supply and outdoor air.
  - 3. Indoor, concealed return located in unconditioned space.
  - 4. Indoor, exposed return located in unconditioned space.
  - 5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
- B. Related Requirements:
  - 1. Section 230716 "HVAC Equipment Insulation."
  - 2. Section 230719 "HVAC Piping Insulation."

1.2 SPECIAL REQUIREMENTS FOR THIS PROJECT

- A. All new indoor supply and all return air metal ductwork shall be insulated with minimum 2 inch thick fiberglass insulation with vapor proof factory jacket. Insulation is required to meet Energy Code requirement of R6.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers are to be marked with the manufacturer's name, appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.5 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

- C. Coordinate installation and testing of heat tracing.

## 1.6 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
  - 1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

### 2.2 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials are to be applied.
- B. Products do not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
- D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.
- E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.
- F. Glass-Fiber Blanket: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 450 deg F in accordance with ASTM C411. Comply with ASTM C553, Type II, and ASTM C1290, Type III with factory-applied FSK jacket . Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- G. Glass-Fiber Board Insulation: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature between 35 deg F and 250 deg F for jacketed and between 35 deg F and 450 deg F for unfaced in accordance with ASTM C411. Comply with ASTM C612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.3 ADHESIVES

- A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

## 2.4 MASTICS AND COATINGS

- A. Materials are compatible with insulation materials, jackets, and substrates.
- B. Vapor-Retarder Mastic, Water Based, Interior Use: Suitable for indoor use on below ambient services.
  - 1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
  - 2. Service Temperature Range: Minus 20 to plus 180 deg F.

## 2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and are compatible with insulation materials, jackets, and substrates.
  - 1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
  - 2. Service Temperature Range: 0 to plus 180 deg F.
  - 3. Color: White.

## 2.6 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
  - 1. Materials are compatible with insulation materials, jackets, and substrates.
  - 2. Fire- and water-resistant, flexible, elastomeric sealant.
  - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 4. Color: Aluminum.

## 2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

## 2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Mesh: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. in. for covering ducts.
- B. Woven Polyester Mesh: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for ducts.

## 2.9 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Cloth: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

## 2.10 TAPES

- A. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

- 1. Width: 2 inches .
- 2. Thickness: 3.7 mils .
- 3. Adhesion: 100 ounces force/inch in width.
- 4. Elongation: 5 percent.
- 5. Tensile Strength: 34 lbf/inch in width.

## 2.11 SECUREMENTS

- A. Bands:

- 1. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal **[or]** closed seal.
- 2. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

- B. Insulation Pins and Hangers:

- 1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
- 2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
- 3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

- a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - b. Spindle: Copper- or zinc-coated, low-carbon steel Aluminum , fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
  - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- 4. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
  - a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - b. Spindle: Copper- or zinc-coated, low-carbon steel Aluminum , fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
  - c. Adhesive-backed base with a peel-off protective cover.
- 5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
  - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, stainless steel .

## 2.12 CORNER ANGLES

- A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum in accordance with ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
  2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

### 3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
1. Comply with requirements in Section 078413 "Penetration Firestopping."

### 3.5 INSTALLATION OF GLASS-FIBER AND MINERAL-WOOL INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
- B. Comply with manufacturer's written installation instructions.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
  - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
  - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
  - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
  - d. Do not overcompress insulation during installation.
  - e. Impale insulation over pins and attach speed washers.
  - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
  - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
  - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

- C. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
    - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
  5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### 3.6 DUCT INSULATION SCHEDULE, GENERAL

#### A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed return located in unconditioned space.
3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

#### B. Items Not Insulated:

1. Factory-insulated flexible ducts.
2. Factory-insulated plenums and casings.
3. Flexible connectors.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.

### 3.7 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

#### A. Where thickness of 2 inches is indicated in the schedules below, the insulation shall meet a minimum performance value of R6 as required by the Energy Code.

#### B. Concealed, round and flat-oval, supply-air duct insulation is the following:

1. Glass-Fiber Blanket: 2 inches thick and 0.75 lb/cu. ft. nominal density.

#### C. Concealed, round and flat-oval, outdoor-air duct insulation is the following:

1. Glass-Fiber Blanket: 2 inches thick and 0.75 lb/cu. ft. nominal density.

#### D. Concealed, rectangular, supply-air duct insulation is one of the following:

1. Glass-Fiber Blanket: 2 inches thick and 0.75 lb/cu. ft. nominal density.
2. Glass-Fiber Board: 2 inches thick and 2 lb/cu. ft. nominal density.

#### E. Concealed, rectangular, return-air duct insulation is one of the following:

1. Glass-Fiber Blanket: 2 inches thick and 0.75 lb/cu. ft. nominal density.
2. Glass-Fiber Board: 2 inches thick and 2 lb/cu. ft. nominal density.

- F. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior is one of the following:
1. Glass-Fiber Blanket: 2 inches thick and 0.75 lb/cu. ft. nominal density.
  2. Glass-Fiber Board: 2 inches thick and 2 lb/cu. ft. nominal density.
- G. Exposed, round and flat-oval, return-air duct insulation is the following:
1. Glass-Fiber Blanket: 2 inches thick and 0.75 lb/cu. ft. nominal density.
- H. Exposed, rectangular, return-air duct insulation is one of the following:
1. Glass-Fiber Blanket: 2 inches thick and 0.75 lb/cu. ft. nominal density.
  2. Glass-Fiber Board: 2 inches thick and 2 lb/cu. ft. nominal density.

END OF SECTION

SECTION 230719  
HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulation for HVAC piping systems.
- B. Related Requirements:
  - 1. Section 230713 "Duct Insulation" for duct insulation.
  - 2. Section 230716 "HVAC Equipment Insulation" for equipment insulation.

1.2 SPECIAL REQUIREMENTS FOR THIS PROJECT

- A. Provide PVC jacket, white in color, on all indoor exposed piping in main mechanical room.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied, if any).

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation system materials are to be delivered to the Project site in unopened containers. The packaging is to include name of manufacturer, fabricator, type, description, and size.

1.5 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.6 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
  - 1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

### 2.2 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials are applied.
- B. Products do not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come into contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
- D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.
- E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric: Closed-cell, or expanded-rubber materials; suitable for maximum use temperature between minus 70 deg F and 220 deg F. Comply with ASTM C534/C534M, Type I, for tubular materials, Type II for sheet materials.
- G. Glass-Fiber, Preformed Pipe: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 850 deg F in accordance with ASTM C411. Comply with ASTM C547.
  - 1. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ .
  - 2. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
- H. Glass-Fiber, Pipe and Tank: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature between 35 deg F and 850 deg F, in accordance with ASTM C411. Comply with ASTM C1393.
  - 1. Semirigid board material with factory-applied ASJ jacket.
  - 2. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.3 INSULATING CEMENTS

- A. Glass-Fiber and Mineral Wool Insulating Cement: Comply with ASTM C195.
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C196.
- C. Glass-Fiber and Mineral Wool Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.

## 2.4 ADHESIVES

- A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.
  - 1. Flame-spread index is 25 or less and smoke-developed index is 50 or less as tested in accordance with ASTM E84.
  - 2. Wet Flash Point: Below 0 deg F.
  - 3. Service Temperature Range: 40 to 200 deg F.
- C. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- D. PVC Jacket Adhesive: Compatible with PVC jacket.

## 2.5 MASTICS AND COATINGS

- A. Materials are compatible with insulation materials, jackets, and substrates.
- B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
  - 1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
  - 2. Service Temperature Range: 0 to plus 180 deg F .
  - 3. Comply with MIL-PRF-19565C, Type II, for permeance requirements.

## 2.6 LAGGING ADHESIVES

- A. Adhesives comply with MIL-A-3316C, Class I, Grade A, and are compatible with insulation materials, jackets, and substrates.
  - 1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
  - 2. Service Temperature Range: 20 to plus 180 deg F .

## 2.7 SEALANTS

- A. Materials are as recommended by the insulation manufacturer and are compatible with insulation materials, jackets, and substrates.
- B. Joint Sealants:
  - 1. Permanently flexible, elastomeric sealant.
    - a. Service Temperature Range: Minus 150 to plus 250 deg F .
    - b. Color: White or gray.
- C. ASJ Flashing Sealants and PVDC and PVC Jacket Flashing Sealants:
  - 1. Fire- and water-resistant, flexible, elastomeric sealant.
  - 2. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 3. Color: White.

## 2.8 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.

## 2.9 FIELD-APPLIED JACKETS

- A. Field-applied jackets comply with ASTM C1136, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  - 1. Adhesive: As recommended by jacket material manufacturer.
  - 2. Color: White .
  - 3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

## 2.10 FIELD-APPLIED FABRIC REINFORCING MESH

- A. Woven Glass-Fiber Mesh: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

## 2.11 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Cloth: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

## 2.12 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
  - 1. Width: 3 inches .
  - 2. Thickness: 11.5 mils .
  - 3. Adhesion: 90 ounces force/inch in width.
  - 4. Elongation: 2 percent.
  - 5. Tensile Strength: 40 lbf/inch in width.
  - 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

## 2.13 SECUREMENTS

- A. Bands:
  - 1. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
  - 2. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4 inch wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, stainless steel .

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
  - 2. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.
- D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the Contract Documents.

- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
  - 3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 2 inches o.c.
  - 4. For below-ambient services, apply vapor-barrier mastic over staples.
  - 5. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
  - 6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.

### 3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  - 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
  - 1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  - 2. Insulate pipe elbows using prefabricated fitting insulation or mitered or routed fittings made from same material and density as that of adjacent pipe insulation. Each piece is butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  - 3. Insulate tee fittings with prefabricated fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  - 4. Insulate valves using prefabricated fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and

including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using prefabricated fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges, mechanical couplings, and unions using a section of oversized preformed pipe insulation to fit. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation conforms to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
  1. Install pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
  4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
  1. Install sections of pipe insulation and miter if required in accordance with manufacturer's written instructions.
  2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
  1. Install prefabricated valve covers manufactured of same material as that of pipe insulation when available.
  2. When prefabricated valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.7 INSTALLATION OF GLASS-FIBER AND MINERAL WOOL INSULATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

#### B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with glass-fiber or mineral-wool blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

#### C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

#### D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated sections are not available, install fabricated sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.8 INSTALLATION OF FIELD-APPLIED JACKETS

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
  1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
  2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
  3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where PVC jackets are indicated and for horizontal applications, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
  1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

### 3.9 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

### 3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Insulation conductivity and thickness per pipe size comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more stringent.
- B. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- C. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  1. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### 3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Chilled Water and Brine, Above 40 Deg F:
  1. NPS 12 and Smaller: Insulation is the following:
    - a. Flexible Elastomeric: 1 inch thick.
    - b. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

- B. Heating-Hot-Water Supply and Return, 200 Deg F and Below:
  - 1. NPS 1.25 and Smaller: Insulation is one of the following:
    - a. Glass-Fiber, Preformed Pipe, Type I: 1.5 inches thick.
  - 2. NPS 2 and Larger: Insulation is the following:
    - a. Glass-Fiber, Preformed Pipe Insulation, Type I or Pipe and Tank Insulation : 2 inches thick.

### 3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection, from materials listed is Contractor's option.
- C. Piping, Exposed:
  - 1. PVC :20 mils thick.

END OF SECTION

SECTION 230813  
MECHANICAL SYSTEMS COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

- A. General requirements that apply to implementation of commissioning of HVAC systems, assemblies and components.
- B. The purpose of this section is to specify Division 23 responsibilities in the commissioning process.
- C. The systems to be commissioned are listed in this Section and in Section 01 91 13.
- D. Commissioning requires the participation of Division 23 Contractor and Subcontractors to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Section 01 91 13. Division 23 Contractor and Subcontractors shall be familiar with all parts of Section 01 91 13 and the commissioning plan issued by the CxA and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of this contract, including General and Supplemental Conditions and Division 01 Specification Sections apply to the Section.
- B. Drawings and general provisions for Division 23.

1.3 RELATED SECTIONS

- A. Division 01 "General Commissioning Requirements".
- B. Division 23 Sections.

1.4 DESCRIPTION

- A. The purpose of this section is to specify Division 23 responsibilities in the commissioning process.
- B. The purpose of commission is to ensure that the Work has been completed as specified and that systems are functioning in the manner as described in the Drawings and Specifications.
- C. In general, onsite Commissioning will commence after preliminary punch list items are completed. Prior to completion of preliminary punch list items, Commissioning will involve offsite (i.e. in office) coordination related to review of Shop Drawings and preliminary TAB issues.
- D. The steps associated with commissioning are outlined below:
  - 1. Step One - Installation Verification
  - 2. Step Two - System Start-Up.

3. Step Three – Functional Performance Testing.

- E. Operational staff training is essential to the commission process and will run concurrently with steps one through three.
- F. Commissioning requires the participation of Division 22 and 23 to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Division 01.
- G. The Commissioning Team will include representatives of the following:
  - 1. The Commissioning Agent (CxA),
  - 2. The Owner, and Owner appointed representatives to include the Engineer of Record and facilities maintenance personnel.
  - 3. The Contractor and his subcontractors, to include the Project Superintendent,
  - 4. Testing and Balancing subcontractor
  - 5. DDC/BAS Controls subcontractors.
  - 6. Equipment manufacturer's representatives will be present for start-up as specified in the equipment specification sections and for equipment training.

1.5 SYSTEMS TO BE COMMISSIONED

- A. Commissioning shall be performed on the following systems:
  - 1. Direct Digital Controls (DDC) for equipment and components.
  - 2. Building Automation System (BAS) for total sum of building.
  - 3. Major HVAC components, such as air handling units and fans, to include:
    - a. Existing RTU.
    - b. Toilet Exhaust Fan.
    - c. New VAV boxes

1.6 RESPONSIBILITIES

- A. General
  - 1. The members of the Commissioning Team shall act to implement the Commissioning Process through coordinated action.
  - 2. Contractor shall assign representatives with expertise and authority to act on Contractor's behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to the following:

- a. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective actions.
- b. Cooperate with CxA for resolution of issues recorded in the Issues Log.
- c. Attend Commissioning Team meetings.
- d. Integrate and coordinate commissioning process activities with construction schedule.
- e. Review and accept commissioning process test procedures provided by the Commissioning Authority.
- f. Complete commissioning process test procedures.

B. Commissioning Agent (CxA) Responsibilities

- 1. Organize and lead the Commissioning Team.
- 2. Provide Commissioning Plan.
- 3. Provide Project-specific construction checklists and commissioning process test procedures.
- 4. Schedule and convene Commissioning Team meetings and oversee communications related to commissioning.
- 5. Verify the execution of the Commissioning process activities.
- 6. Prepare and maintain the Issues Log.
- 7. Prepare and maintain completed construction checklist log.
- 8. Compile test data, inspection reports, and certificates. Include them in the systems manual and commissioning process report.

C. HVAC, Controls and TAB: The commissioning responsibilities include the following:

- 1. Construction and Acceptance Contractors
- 2. For each purchase order or subcontract written, include requirements for submittal data, commissioning documentation and Operations and Maintenance (O&M) data. Data to be reviewed by CxA concurrent to Architect/Engineer review.
- 3. Attend a commissioning scoping meeting and other meetings necessary to facilitate the Commissioning process.
- 4. Provide CxA with shop drawing submittals.
- 5. Provide additional requested documentation, prior to normal O&M manual submittals, to the CxA for development of start-up and functional testing procedures.

6. Contractor shall assist in clarifying the operation and control of commissioned equipment in area where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
7. Provide assistance to the CxA in preparing the specific functional performance test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.
8. Develop a start-up and initial checkout plan using manufacturer's start-up procedures and the pre-functional checklists from the CxA for all commissioned equipment. Submit to CxA for review and approval prior to start-up.
9. During the start-up and initial checkout process, execute the mechanical-related portions of the pre-functional checklists for all commissioned equipment.
10. Perform and clearly document all completed start-up and system operational checkout procedures, providing a copy to the CxA.
11. Address Architect/Engineer punch list items before functional testing. Air and water TAB shall be completed with discrepancies and problems remedied before functional testing of the respective system. Note that this requires that the TAB Report be approved by the Engineer of Record prior to the beginning of TAB Verification and Functional Performance Testing.
12. Contractor shall provide skilled technicians to execute equipment start-up and to execute the functional performance tests.
13. Provide skilled technicians to perform functional performance testing under the direction of the CxA for equipment to be commissioned.
14. Correct deficiencies as identified by the CxA and the Architect/Engineer.
15. Prepare O&M Manuals including clarifying and updating the original sequences of operation to as-built conditions.
16. Update As-Built Drawings after completion of commissioning.

D. Division 23 Mechanical Contractor/Subcontractors

1. Provide start-up for all HVAC equipment.
2. Assist the TAB effort and the CxA by:
  - a. Placing all HVAC equipment and systems into operation and continue to operate during each work day of TAB and commissioning, as required.
  - b. Provide temperature and pressure taps according to the Construction Documents for TAB and commissioning testing.
3. Provide a P/T plug at each water sensor which is an input point to the control system.

E. Division 23 Controls Contractor/Subcontractor

1. Sequence of Operation Submittals, including
  - a. Overview narrative of the system generally describing its purpose, components and function.
  - b. All interactions and interlocks with other systems.
  - c. Start-up sequences.
  - d. Morning warmup, morning cool-down, normal mode and shutdown mode operation of equipment.
  - e. Occupied Temperature and Unoccupied Temperature Schedules.
  - f. Occupied Ventilation and Unoccupied Ventilation Schedules.
  - g. Sequences for all alarms and emergency shut-downs.
  - h. Initial and recommended values for all adjustable settings, set points and parameters that are typically set or adjusted by operating staff.
  - i. Operating schedules, if known.
2. Assist the CxA by providing a skilled technician who is familiar with the building to execute the functional testing of the controls system.
3. Execute all control system trend logs.
4. Provide a signed and dated certification to the CxA upon completion of the system checkout for each controlled device, equipment and system that states all systems programming is complete except for functional testing.
5. On a set of As-Built Drawings, list and clearly identify the locations of all static and differential pressure sensors.

F. TAB Contractor/Subcontractor

1. Provide all field checkout sheets and logs to be used that list each piece of equipment to be tested, adjusted and balanced, with the data cells for each.
2. Final test report forms to be used.
3. A running log of events and issues shall be kept by the TAB field technicians.
4. Provide a draft TAB Report to the CxA.
5. Provide the CxA with any requested data gathered but not shown on the Report.

G. Owner Responsibilities

1. Provide any Owner Project Responsibilities (OPR) documentation to the CxA and Contractor for information and use.

2. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.
3. Provide any Basis of Design documentation prepared by Engineer and approved by Owner to the CxA and Contractor for use in developing the Commissioning Plan, systems manuals, and operation and maintenance training plan.

## 1.7 SUBMITTALS

- A. Submit documentation relative to commissioning as required in this Section and in Section 01 91 13.
- B. Submit Commissioning Plan.
- C. Submit Functional Performance Test (FPT) procedures.
- D. Provide review comments on Shop Drawings for equipment and systems to be commissioned.
- E. Submit completed pre-functional checklist.
- F. Submit Functional Performance Test report. List problems that were corrected, problems that were discovered and not corrected and recommendation to take corrective party and the party to take action.
- G. Review and comment of Testing, Adjusting and Balancing (TAB) Report.
- H. Review and comment of O&M Manuals.
- I. Review and comment of the Training Plan and the completed Training Procedures.

## PART 2 - PRODUCTS

### 2.1 COMMISSIONING PLAN

- A. The Commissioning Plan shall outline the organization, scheduling, team members and documentation pertaining to the overall commissioning process.

### 2.2 NARRATIVE DESCRIPTIONS

- A. Provide a narrative description of the design intent of the systems to be commissioned and their intended modes of sequence of operations.

### 2.3 FUNCTIONAL PERFORMANCE TESTS (FPT) PROCEDURES

- A. The FPT procedures at the minimum shall consist of the following sections:

1. Narrative Description.
2. Testing Prerequisites:

a. This section shall contain verification that primary mechanical, electrical and control systems that support or interact with the system that the FPT is prepared against are completed, tested and operational.

3. Installation Verification:

a. This section contains verification that the system installation is completed and is ready for commissioning.

4. Commencement of the Functional Performance Testing:

a. This section records the date and time of the start of system commissioning.

5. System Condition Prior to Starting Performance Testing:

a. This section records the current set points and parameters of the system at the start of commissioning.

6. Functional Performance Test:

a. This section shall provide the following:

1) Sequential steps required to set parameters and conditions required to test component and functions throughout the intended range of operations.

2) Full range of checks and tests carried out to determine if electrical connections, components, subsystems, systems and interfaces between systems shall function in accordance with the Contract Documents.

3) All modes and sequences, interlocks and conditional control responses.

4) Operation to abnormal emergency conditions.

7. End of Functional Performance Test:

a. This section records the date and time of the end of the system commissioning.

8. Field Notes:

a. This section records notes or remarks during system commissioning.

9. List system modifications not required by Contract Documents but provided by the Subcontractor.

10. List problems discovered during Commissioning that were corrected.

11. List problems discovered during Commissioning that were not corrected.

a. List recommended party or persons responsible to resolve problems.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. The Division 23 Subcontractors shall be responsible for performing procedures presented in specification and contract drawings and as detailed in the Functional Performance Tests (FPT). Members of the designated Commissioning Team shall witness various portions of the commissioning process. Responsibilities for these activities are listed in the following

paragraphs. Commissioning Team members shall sign-off on appropriate sections after verifying installation, operation, or documentation. Final sign-off shall be by the Commissioning Agent.

- B. Any test ports, gauges, test equipment, etc., needed to accomplish the functional performance tests shall be provided by Subcontractors.
- C. Subcontractors shall provide to the Commissioning Team documentation of calibration of controls. Documentation shall include dates, setpoints, calibration coefficients, control loop verification, and other data required to verify system check-out. Documentation shall be dated and initialed by field engineer or technician performing the work.

### 3.2 OPERATIONAL STAFF TRAINING

- A. System narrative descriptions will be prepared by the Commission Agent and supported by flow diagrams, one line diagrams, and appropriate specification sections for major systems to be commissioned. The Commission Agent will coordinate "system description" meetings with members of facility maintenance department groups to review system description documentation. The meetings will provide an overview of major system features, components, and arrangements.
- B. The Subcontractor and associated manufacturer's representatives shall provide required training to operational staff after the system description meetings have occurred. The Subcontractor training sessions shall provide a more detailed analogy of systems operation and maintenance.

### 3.3 INSTRUMENTATION

- A. Instrumentation shall be provided by the Div 23 Contractor and Subcontractors. Instruments used for measurements shall be accurate. Calibration histories for each instrument shall be available for examination.
- B. Calibration and maintenance of instruments shall be in accordance with the requirements of NEBB or AABC Standards.

### 3.4 DOCUMENTATION

- A. The installing Subcontractor shall be responsible for collection of pertinent data during system start-up and functional performance testing. The Subcontractor shall submit to the Commissioning Agent documentation of tests performed prior to and after system start-up. Documentation shall also include start-up procedures as approved by Commissioning Team.
- B. Documentation is to be typewritten on 8-1/2 by 11 inches (200 by 280 mm) paper and inserted in a 2 inches (50 mm) to 3 inches (75 mm) thick three ring binder. Indicate the project name, number, volume number, and volume title on the end panel of each binder. If acceptable by
  - 1. If acceptable by Owner and Commissioning Agent, documentation may be submitted as Adobe Acrobat ".pdf" files.
  - 2. Provide a title sheet for each volume and list the following:
    - a. Volume Title and Section Name and Number requiring this submittal.

- b. Project name, project number, and address.
- c. Subcontractor name, address, and phone number.
- d. Name, title, signature, and date of person making the submittal.
- e. Name of University, a blank line for signature, and the date of person accepting the submittal.
- f. Name, address, and phone number of Commission Agent; a blank line for signature; and date of person accepting the submittal.
- g. Provide a Table of Contents for multiple submittals. List each submittal and page number. Number each page, centered on the bottom in sequential numerical order. Provide tabs for multiple submittals in a single binder.

### 3.5 STEP ONE - INSTALLATION VERIFICATION

General Commissioning responsibilities:

- 1. Before system start-up begins, the Commissioning Team shall conduct a final installation verification audit. The Subcontractor shall be responsible for completion of work including change orders and punch list items to the University's satisfaction. The audit shall include, but not be limited to, checking of:
  - a. Piping specialties including balance, control, and isolation valves.
  - b. Ductwork specialty items including turning devices, balance, fire, smoke, control dampers, and access doors.
  - c. Control sensor types and location.
  - d. Identification of piping, valves, equipment, controls, etc.
  - e. Major equipment, pumps, valves, starters, gauges, thermometers, etc.
  - f. Documentation of prestart-up tests performed, including manufacturer's factory tests.
- 2. If work is found to be incomplete, incorrect, or non-functional, the Subcontractor shall correct the deficiency before system start-up work proceeds.

### 3.6 STEP TWO - SYSTEM START-UP

General Commissioning Responsibilities:

- 1. A start-up plan shall be developed and submitted by the installing Subcontractor. Start-up plan to include the following:
  - a. Flushing and cleaning of pipe.
  - b. Filters, strainers, and screens.
  - c. Valve/damper positions.

- d. Electrical tests.
  - e. Pressure tests.
  - f. Safeties.
  - g. Chemical treatment.
  - h. Manufacturer's tests.
- 2. The start-up plan will be reviewed and a prestart-up inspection performed by designated members of the Commissioning Team. The installing Subcontractor shall commence with system start-up after approval has been given to start-up plan and the prestart-up inspection is completed. Designated members of the Commissioning Team shall witness system start-up and list system and equipment deficiencies noted during start-up. The Subcontractor shall take corrective action on system deficiencies noted and demonstrate to the Commissioning Team members suitable system operation.
  - 3. Designated systems requiring test and balance work shall have this activity commence after systems have successfully completed start-up. System and equipment deficiencies observed during this activity is to be noted and corrected.

### 3.7 STEP THREE - FUNCTIONAL PERFORMANCE TESTING

#### A. General Commissioning Responsibilities:

- 1. Functional Performance Testing begins after operational testing, adjusting, and balancing of the systems have been completed by the Subcontractors; and the System Description and Hands-on Training sessions have been completed.
- 2. The objective of the Functional Performance Testing is to advance the building systems from a state of substantial completion to full dynamic operation in accordance with the specified design requirements and design intent.
- 3. Develop individual systems testing protocols which, when implemented by the Subcontractor, will allow the Commissioning Team to observe, evaluate, identify deficiencies, recommend modifications, tune, and document the systems and systems equipment performance over a range of load and functional levels.
- 4. Functional Performance tests for the systems to be commissioned shall be defined in the Commissioning Plan. These tests are intended to be conclusive but may require minor modifications as system operation dictates.

END OF SECTION

SECTION 230923  
DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Direct digital control (DDC) system equipment and components for monitoring and controlling of HVAC, exclusive of instrumentation and control devices.

B. Related Requirements:

1. Section 230923.11 "Control Valves".
2. Section 230923.27 "Temperature Instruments"
3. Section 233300 "Air Terminal Units"

1.2 Scope of work:

- A. The controls contractor shall modify and extend the existing building automation system as required to accommodate the new VAV boxes, temperature controls, and exhaust fan. Provide and install all controllers as required for the building for monitoring and controlling all mechanical equipment, refer to mechanical plan M501, MECHANICAL CONTROLS for additional information and the sequence of operations.

1.3 DEFINITIONS

- A. Algorithm: A logical procedure for solving a recurrent mathematical problem. A prescribed set of well-defined rules or processes for solving a problem in a finite number of steps.
- B. Analog: A continuously varying signal value, such as current, flow, pressure, or temperature.
- C. BACnet Specific Definitions:
1. BACnet: Building Automation Control Network Protocol, ASHRAE 135. A communications protocol allowing devices to communicate data and services over a network.
  2. BACnet Interoperability Building Blocks (BIBBs): BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device.
  3. BACnet/IP: Defines and allows using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number.

4. BACnet Testing Laboratories (BTL): Organization responsible for testing products for compliance with ASHRAE 135, operated under direction of BACnet International.
- D. Binary: Two-state signal where a high signal level represents "ON" or "OPEN" condition and a low signal level represents "OFF" or "CLOSED" condition. "Digital" is sometimes used interchangeably with "Binary" to indicate a two-state signal.
- E. Controller: Generic term for any standalone, microprocessor-based, digital controller residing on a network, used for local or global control. Three types of controllers are indicated: network controllers, programmable application controllers, and application-specific controllers.
- F. Control System Integrator: An entity that assists in expansion of existing enterprise system and support of additional operator interfaces to I/O being added to existing enterprise system.
- G. COV: Changes of value.
- H. DDC System Provider: Authorized representative of, and trained by, DDC system manufacturer and responsible for execution of DDC system Work indicated.
- I. Distributed Control: Processing of system data is decentralized and control decisions are made at subsystem level. System operational programs and information are provided to remote subsystems and status is reported back. On loss of communication, subsystems to be capable of operating in a standalone mode using the last best available data.
- J. Gateway: Bidirectional protocol translator that connects control systems that use different communication protocols.
- K. HLC: Heavy load conditions.
- L. I/O: System through which information is received and transmitted. I/O refers to analog input (AI), binary input (BI), analog output (AO) and binary output (BO). Analog signals are continuous and represent control influences such as flow, level, moisture, pressure, and temperature. Binary signals convert electronic signals to digital pulses (values) and generally represent two-position operating and alarm status. "Digital," (DI) and (DO), is sometimes used interchangeably with "Binary," (BI) and (BO), respectively.
- M. LAN: Local area network.
- N. 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.
- O. Mobile Device: A data-enabled phone or tablet computer capable of connecting to a cellular data network and running a native control application or accessing a web interface.
- P. MS/TP: Master-slave/token-passing, ISO/IEC/IEEE 8802-3. Datalink protocol LAN option that uses twisted-pair wire for low-speed communication.

- Q. MTBF: Mean time between failures.
- R. Network Controller: Digital controller, which supports a family of programmable application controllers and application-specific controllers, that communicates on peer-to-peer network for transmission of global data.
- S. Network Repeater: Device that receives data packet from one network and rebroadcasts it to another network. No routing information is added to protocol.
- T. Peer to Peer: Networking architecture that treats all network stations as equal partners.
- U. POT: Portable operator's terminal.
- V. RAM: Random access memory.
- W. RF: Radio frequency.
- X. Router: Device connecting two or more networks at network layer.
- Y. Server: Computer used to maintain system configuration, historical and programming database.
- Z. TCP/IP: Transport control protocol/Internet protocol.
- AA. UPS: Uninterruptible power supply.
- BB. USB: Universal Serial Bus.
- CC. User Datagram Protocol (UDP): This protocol assumes that the IP is used as the underlying protocol.
- DD. VAV: Variable air volume.
- EE. WLED: White light emitting diode.

#### 1.4 ACTION SUBMITTALS

- A. Product Data:
  - 1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
  - 3. Product description with complete technical data, performance curves, and product specification sheets.
  - 4. Installation, operation, and maintenance instructions including factors effecting performance.

## 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials and parts to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Include product manufacturers' recommended parts lists for proper product operation over four -year period following warranty period. Parts list to be indicated for each year.
- C. Furnish parts, as indicated by manufacturer's recommended parts list, for product operation during one -year period following warranty period.

## PART 2 - PRODUCTS

### 2.1 DDC SYSTEM DESCRIPTION

- A. Microprocessor-based monitoring and control including analog/digital conversion and program logic. A control loop or subsystem in which digital and analog information is received and processed by a microprocessor, and digital control signals are generated based on control algorithms and transmitted to field devices to achieve a set of predefined conditions.
  - 1. DDC system consisting of peer-to-peer network of distributed DDC controllers , other network devices, operator interfaces, and software.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Delivery of selected control devices to equipment and systems manufacturers for factory installation and to HVAC systems installers for field installation.
- B. DDC System Speed:
  - 1. Response Time of Connected I/O:
    - a. Update AI point values connected to DDC system at least every five seconds for use by DDC controllers. Points used globally to also comply with this requirement.
    - b. Update BI point values connected to DDC system at least every five seconds for use by DDC controllers. Points used globally to also comply with this requirement.
    - c. AO points connected to DDC system to begin to respond to controller output commands within two second(s). Global commands to also comply with this requirement.

- d. BO point values connected to DDC system to respond to controller output commands within two second(s). Global commands to also comply with this requirement.
  - 2. Display of Connected I/O:
    - a. Update and display analog point COV connected to DDC system at least every 10 seconds for use by operator.
    - b. Update and display binary point COV connected to DDC system at least every 10 seconds for use by operator.
    - c. Update and display alarms of analog and digital points connected to DDC system within 45 seconds of activation or change of state.
    - d. Update graphic display refresh within eight seconds.
    - e. Point change of values and alarms displayed from workstation to workstation when multiple operators are viewing from multiple workstations to not exceed graphic refresh rate indicated.
- C. Input Point Values Displayed Accuracy: Meet following end-to-end overall system accuracy, including errors associated with meter, sensor, transmitter, lead wire or cable, and analog to digital conversion.
  - 1. Energy:
    - a. Thermal: Within 5 percent of reading.
    - b. Electric Power: Within 1 percent of reading.
    - c. Requirements indicated on Drawings for meters not supplied by utility.
  - 2. Flow:
    - a. Air: Within 5 percent of design flow rate.
    - b. Air (Terminal Units): Within 10 percent of design flow rate.
    - c. Water: Within 2 percent of design flow rate.
  - 3. Gas:
    - a. Carbon Dioxide: Within 50 ppm.
  - 4. Moisture (Relative Humidity):
    - a. Air: Within 5 percent RH.
    - b. Space: Within 5 percent RH.
    - c. Outdoor: Within 5 percent RH.
  - 5. Level: Within 5 percent of reading.
  - 6. Pressure:
    - a. Air, Ducts and Equipment: 1 percent of instrument range .
    - b. Space: Within 1 percent of instrument range .
  - 7. Speed: Within 10 percent of reading.
  - 8. Temperature, Dew Point:
    - a. Air: Within 1 deg F .
    - b. Space: Within 1 deg F .
    - c. Outdoor: Within 3 deg F .
  - 9. Temperature, Dry Bulb:
    - a. Air: Within 1 deg F .
    - b. Space: Within 1 deg F .
    - c. Outdoor: Within 2 deg F .
    - d. Other Temperatures Not Indicated: Within 1 deg F .
  - 10. Temperature, Wet Bulb:
    - a. Air: Within 1 deg F .
    - b. Space: Within 1 deg F .
    - c. Outdoor: Within 2 deg F .

- D. Precision of I/O Reported Values: Values reported in database and displayed to have following precision:
1. Current:
    - a. Amperes: Nearest 1/10th of an ampere up to 100 A; nearest ampere for 100 A and more.
  2. Flow:
    - a. Air: Nearest 1/10th of a cubic feet per minute through 100 cfm; nearest cubic feet per minute between 100 and 1000 cfm; nearest 10 cfm between 1000 and 10,000 cfm; nearest 100 cfm above 10,000 cfm.
  3. Gas:
    - a. Carbon Dioxide (ppm): Nearest ppm.
  4. Moisture (Relative Humidity):
    - a. Relative Humidity (Percentage): Nearest 1 percent.
  5. Speed:
    - a. Rotation (rpm): Nearest 1 rpm.
    - b. Velocity: Nearest 1/10th of feet per minute through 100 fpm; nearest feet per minute between 100 and 1000 fpm; nearest 10 fpm above 1000 fpm.
  6. Position, Dampers and Valves (Percentage Open): Nearest 1 percent.
  7. Pressure:
    - a. Air, Ducts and Equipment: Nearest 1/10th of an inch water closet.
    - b. Space: Nearest 1/100th of an inch water closet.
  8. Temperature:
    - a. Air, Ducts and Equipment: Nearest 1/10th of a degree.
    - b. Outdoor: Nearest degree.
    - c. Space: Nearest 1/10th of a degree.
  9. Voltage: Nearest 1/10 V up to 100 V; nearest volt above 100 V.
- E. Environmental Conditions for Controllers, Gateways, and Routers:
1. Products to operate without performance degradation under ambient environmental temperature, pressure, and humidity conditions encountered for installed location.
- F. Environmental Conditions for Instruments and Actuators:
1. Instruments and actuators to operate without performance degradation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified and encountered for installed location.
- G. DDC System Reliability:
1. Design, install, and configure DDC controllers, gateways, routers, to yield a MTBF of at least 40,000 hours, based on a confidence level of at least 90 percent. MTBF value includes any failure for any reason to any part of products indicated.
- H. Electric Power Quality:
1. Power-Line Surges:

- a. Protect susceptible DDC system products connected to ac power circuits from power-line surges to comply with requirements of IEEE C62.41.1 and IEEE C62.41.2.
  - b. Do not use fuses for surge protection.
- 2. Ground Fault: Protect products from ground fault by providing suitable grounding. Products to not fail due to ground fault condition.

## 2.3 SYSTEM ARCHITECTURE

- A. System architecture:
  - 1. Connect application-specific controllers to programmable application controllers and to network controllers .
- B. Minimum Data Transfer and Communication Speed:
  - 1. LAN Connecting Operator Workstations and Network Controllers: 100 Mbps.
  - 2. LAN Connecting Programmable Application Controllers: 1000 kbps.
  - 3. LAN Connecting Application-Specific Controllers: 115,000 bps.
- C. Provide dedicated DDC system LANs that are not shared with other building systems and tenant data and communication networks.
- D. Configure architecture to eliminate or minimize need to remove and replace existing network equipment for system expansion.
- E. Make number of LANs and associated communication transparent to operator. Configure all I/O points residing on any LAN to be capable of global sharing between all system LANs.
- F. Design system to eliminate dependence on any single device for system alarm reporting and control execution. Design each controller to operate independently by performing own control, alarm management, and historical data collection.
- G. Special Network Architecture Requirements:
  - 1. Air-Handling Systems: For control applications of an air-handling system that consists of air-handling unit(s) and VAV terminal units, include a dedicated LAN of application-specific controllers serving VAV terminal units connected directly to controller that is controlling air-handling-system air-handling unit(s). Basically, create DDC system LAN that aligns with air-handling system being controlled.

## 2.4 NETWORKS

- A. Acceptable networks for connecting workstations, mobile devices, and network controllers include the following:
  - 1. ISO/IEC/IEEE 8802-3, Ethernet.

- B. Acceptable networks for connecting programmable application controllers include the following:
  - 1. ISO/IEC/IEEE 8802-3, Ethernet.
- C. Acceptable networks for connecting application-specific controllers include the following:
  - 1. ISO/IEC/IEEE 8802-3, Ethernet.

## 2.5 NETWORK COMMUNICATION PROTOCOL

- A. Use network communication protocol(s) that are open to Owner and available to other companies for use in making future modifications to DDC system.

## 2.6 DDC CONTROLLERS

- A. DDC system consisting of a combination of network controllers, programmable application controllers, and application-specific controllers to satisfy performance requirements indicated.
- B. DDC controllers to perform monitoring, control, energy optimization, and other requirements indicated.
- C. DDC controllers are to use a multitasking, multiuser, real-time digital control microprocessor with a distributed network database and intelligence.
- D. Each DDC controller is capable of full and complete operation as a completely independent unit and as a part of DDC system wide distributed network.
- E. Environment Requirements:
  - 1. Controller hardware suitable for anticipated ambient conditions.
- F. Power and Noise Immunity:
  - 1. Operate controller at 90 to 110 percent of nominal voltage rating and perform an orderly shutdown below 80 percent of nominal voltage.
  - 2. Protect against electrical noise of 5 to 120 Hz and from keyed radios with up to 5 W of power located within 36 inches of enclosure.
- G. DDC Controller Spare Processing Capacity:
  - 1. Include spare processing memory for each controller. RAM, PROM, or EEPROM will implement requirements indicated with the following spare memory:
    - a. Network Controllers: 50 percent.
    - b. Programmable Application Controllers: Not less than 60 percent.
    - c. Application-Specific Controllers: Not less than 70 percent.
  - 2. Memory for DDC controller's operating system and database are to include the following:

- a. Monitoring and control.
  - b. Energy management, operation, and optimization applications.
  - c. Alarm management.
  - d. Historical trend data of all connected I/O points.
  - e. Maintenance applications.
  - f. Operator interfaces.
  - g. Monitoring of manual overrides.
- H. DDC Controller Spare I/O Point Capacity: Include spare I/O point capacity for each controller as follows:
  - 1. Network Controllers:
    - a. 10 percent of each AI, AO, BI, and BO point connected to controller.
    - b. Minimum Spare I/O Points per Controller:
      - 1) AIs: Two .
      - 2) AOs: Two .
      - 3) BIs: Three .
      - 4) BOs: Three .
      - 5) Option to provide universal I/O to meet spare requirements.
  - 2. Programmable Application Controllers:
    - a. 10 percent of each AI, AO, BI, and BO point connected to controller.
    - b. Minimum Spare I/O Points per Controller:
      - 1) AIs: Two .
      - 2) AOs: Two .
      - 3) BIs: Three .
      - 4) BOs: Three .
      - 5) Option to provide universal I/O to meet spare requirements.
  - 3. Application-Specific Controllers:
    - a. 10 percent of each AI, AO, BI, and BO point connected to controller.
    - b. Minimum Spare I/O Points per Controller:
      - 1) AIs: One .
      - 2) AOs: One .
      - 3) BIs: One .
      - 4) BOs: One .
      - 5) Option to provide universal I/O to meet spare requirements.
- I. Maintenance and Support: Include the following features to facilitate maintenance and support:
  - 1. Mount microprocessor components on circuit cards for ease of removal and replacement.
  - 2. Means to quickly and easily disconnect controller from network.
  - 3. Means to quickly and easily access connect to field test equipment.
  - 4. Visual indication that controller electric power is on, of communication fault or trouble, and that controller is receiving and sending signals to network.
- J. I/O Point Interface:
  - 1. Connect hardwired I/O points to network, programmable application, and application-specific controllers.

2. Protect I/O points so shorting of point to itself, to another point, or to ground will not damage controller.
3. Protect I/O points from voltage up to 24 V of any duration so that contact will not damage controller.
4. AIs:
  - a. Include monitoring of low-voltage (0 to 10 V dc), current (4 to 20 mA) and resistance signals from thermistor and RTD sensors.
  - b. Compatible with, and field configurable to, sensor and transmitters installed.
  - c. Perform analog-to-digital (A-to-D) conversion with a minimum resolution of 8 bits or better to comply with accuracy requirements indicated.
  - d. Signal conditioning including transient rejection for each AI.
  - e. Capable of being individually calibrated for zero and span.
  - f. Incorporate common-mode noise rejection of at least 50 dB from 0 to 100 Hz for differential inputs, and normal-mode noise rejection of at least 20 dB at 60 Hz from a source impedance of 10000 ohms.
  - g. External conversion resistors are not permitted.
5. AOs:
  - a. Perform analog-to-digital (A-to-D) conversion with a minimum resolution of 8 bits or better to comply with accuracy requirements indicated.
  - b. Output signals range of 4 to 20 mA dc or 0 to 10 V dc as required to include proper control of output device.
  - c. Capable of being individually calibrated for zero and span.
  - d. Drift is to be not greater than 0.4 percent of range per year.
  - e. External conversion resistors are not permitted.
6. BIs:
  - a. Accept contact closures and ignore transients of less than 5 ms duration.
  - b. Isolate and protect against an applied steady-state voltage of up to 180 V ac peak.
  - c. Include a wetting current of at least 12 mA to be compatible with commonly available control devices and protected against effects of contact bounce and noise.
  - d. Sense "dry contact" closure without external power (other than that provided by controller) being applied.
  - e. Pulse accumulation input points complying with all requirements of BIs and accept up to 10 pulses per second for pulse accumulation. Include buffer to totalize pulses. Pulse accumulator is to accept rates of at least 20 pulses per second. Reset the totalized value to zero on operator's command.
7. BOs:
  - a. Include relay contact closures or triac outputs for momentary and maintained operation of output devices.
    - 1) Relay contact closures to have a minimum duration of 0.1 second and at least 180 V of isolation.
    - 2) Include electromagnetic interference suppression on all output lines to limit transients to non-damaging levels.
    - 3) Minimum contact rating to be 1 A at 24 V ac.
    - 4) Triac outputs to have at least 180 V of isolation and minimum contact rating of 1 A at 24 V ac.
  - b. Include BOs with two-state operation or a pulsed low-voltage signal for pulse-width modulation control.
  - c. BOs to be selectable for either normally open or normally closed operation.

- d. Include tristate outputs (two coordinated BOs) for control of three-point, floating-type electronic actuators without feedback.
- e. Limit use of three-point floating devices to VAV terminal unit control applications, and other applications indicated on Drawings. Control algorithms to operate actuator to one end of its stroke once every 12 hours for verification of operator tracking.

## 2.7 NETWORK CONTROLLERS

### A. General:

- 1. Include adequate number of controllers to achieve performance indicated.
- 2. Provide one or more independent, standalone, microprocessor-based network controllers to manage global strategies indicated.
- 3. Include enough memory to support its operating system, database, and programming requirements with spare memory indicated.
- 4. Share data between networked controllers and other network devices.
- 5. Operating system of controller to manage I/O communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
- 6. Include network controllers with a real-time clock.
- 7. Controller to continually check status of its processor and memory circuits. If an abnormal operation is detected, controller is to assume a predetermined failure mode and generate an alarm notification.
- 8. Make controllers fully programmable.

### B. Communication:

- 1. Network controllers communicate with other devices on DDC system.

### C. Operator Interface:

- 1. Equip controllers with a service communications port for connection to portable operator's workstation or mobile device.

## 2.8 PROGRAMMABLE APPLICATION CONTROLLERS

### A. General:

- 1. Include adequate number of controllers to achieve performance indicated.
- 2. Provide enough memory to support its operating system, database, and programming requirements with spare memory indicated.
- 3. Share data between networked controllers and other network devices.
- 4. Include controller with operating system to manage I/O communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
- 5. Include controllers that perform scheduling with a real-time clock.

6. Controller is to continually check status of its processor and memory circuits. If an abnormal operation is detected, controller assumes a predetermined failure mode and generates an alarm notification.
7. Fully programmable.

B. Communication:

1. Programmable application controllers are to communicate with other devices on network.

C. Operator Interface:

1. Equip controllers with a service communications port for connection to portable operator's workstation POT or mobile device.

## 2.9 APPLICATION-SPECIFIC CONTROLLERS

A. Description: Microprocessor-based controllers, which through hardware or firmware design are dedicated to control a specific piece of equipment or system. Controllers are not fully user-programmable but are configurable and customizable for operation of equipment they are designed to control.

1. Capable of standalone operation and continued control functions without being connected to network.
2. Share data between networked controllers and other network devices.

B. Communication: Application-specific controllers are to communicate with other application-specific controllers and devices on network, and to programmable application controllers and network controllers.

C. Operator Interface: Equip controllers with a service communications port for connection to portable operator's workstation POT or mobile device . Connection is to extend to port on space temperature sensor that is connected to controller.

## 2.10 ENCLOSURES

A. General:

1. House each controller and associated control accessories in single enclosure. Enclosure is to serve as central tie-in point for control devices such as switches, transmitters, transducers, power supplies, and transformers.
2. Do not house more than one controller in single enclosure.
3. Include enclosure door with key locking mechanism. Key locks alike for all enclosures and include one pair of keys per enclosure.

## 2.11 RELAYS

A. General-Purpose Relays:

1. NRTL listed.
2. Heavy-duty, electromechanical type; rated for at least 10 A at 250 V ac and 60 Hz.
3. SPDT, DPDT, or three-pole double-throw, as required by control application.
4. Plug-in-style relay with 8-pin octal or multiblade plug for DPDT relays and 11-pin octal or multiblade plug for three-pole double-throw relays.
5. Construct contacts of silver, silver alloy, or gold.
6. Enclose relay in a polycarbonate dust-tight cover.
7. Include LED indication and push-to-test button to test manual operation of relay without power on coil.
8. Performance:
  - a. Mechanical Life: At least 10 million cycles.
  - b. Electrical Life: At least 100,000 cycles at rated load.
  - c. Pickup Time: 15 ms or less.
  - d. Dropout Time: 10 ms or less.
  - e. Pull-in Voltage: 85 percent of rated voltage.
  - f. Dropout Voltage: 50 percent of nominal rated voltage.
  - g. Power Consumption: 2.5 VA or less.
  - h. Ambient Operating Temperatures: Minus 40 to 115 deg F.
9. Equip relays with coil transient suppression to limit transients to non-damaging levels.
10. Plug each relay into industry-standard, 35 mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
11. Include relay socket with screw terminals. Mold into socket the coincident screw terminal numbers.

B. Multifunction Time-Delay Relays:

1. NRTL listed.
2. Continuous-duty type, rated for at least 10 A at 240 V ac and 60 Hz.
3. Relay with up to 4 programmable functions to provide on/off delay, interval, and recycle timing functions.
4. Plug-in-style relay with either multi-pin or blade plug.
5. Construct contacts of silver, silver alloy, or gold.
6. Enclose relay in a dust-tight cover.
7. Include knob and dial scale for alternative digital interface for setting delay time.
8. Visual Status Indication: Power "On" and Output "On" status.
9. Performance:
  - a. Mechanical Life: At least 10 million cycles.
  - b. Electrical Life: At least 100,000 cycles at rated load.
  - c. Timing Ranges: Multiple ranges from 0.1 seconds to 100 minutes.
  - d. Repeatability: Within 2 percent.
  - e. Recycle Time: 45 ms.
  - f. Minimum Pulse-Width Control: 50 ms.
  - g. Power Consumption: 5 VA or less.
  - h. Ambient Operating Temperatures: Minus 40 to 115 deg F.
10. Equip relays with transient suppression to limit transients to non-damaging levels.
11. Plug each relay into industry-standard, 35 mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.

12. Include relay socket with screw terminals. Mold into socket the coincident screw terminal numbers.

C. Latching Relays:

1. NRTL listed.
2. Continuous-duty type, rated for at least 10 A at 250 V ac and 60 Hz.
3. SPDT, DPDT, or three-pole double-throw, as required by control application.
4. Plug-in-style relay with either multi-pin or blade plug.
5. Construct contacts of silver, silver alloy, or gold.
6. Enclose relay in a polycarbonate dust-tight cover.
7. Performance:
  - a. Mechanical Life: At least 10 million cycles.
  - b. Electrical Life: At least 100,000 cycles at rated load.
  - c. Pickup Time: 15 ms or less.
  - d. Dropout Time: 10 ms or less.
  - e. Pull-in Voltage: 85 percent of rated voltage.
  - f. Dropout Voltage: 50 percent of nominal rated voltage.
  - g. Power Consumption: 2 VA or less.
  - h. Ambient Operating Temperatures: Minus 40 to 115 deg F.
8. Equip relays with coil transient suppression to limit transients to non-damaging levels.
9. Plug each relay into industry-standard, 35 mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
10. Relay socket with screw terminals. Mold into socket the coincident screw terminal numbers.

D. Current Sensing Relays:

1. NRTL listed.
2. Monitors ac current.
3. Independent adjustable controls for pickup and dropout current.
4. Energized when supply voltage is present and current is above pickup setting.
5. De-energizes when monitored current is below dropout current.
6. Dropout current is adjustable from 50 to 95 percent of pickup current.
7. Visual indication of contact status.
8. Include current transformer, if required for application.
9. House current sensing relay and current transformer if required in its own enclosure. Use NEMA 250, Type 1 enclosure for indoors applications and NEMA 250, Type 4 or Type 4X for outdoor applications.

E. Combination On-Off Status Sensor and On-Off Control Relays:

1. Description:
  - a. On-off control and on-off status indication in a single device.
  - b. LED status indication of activated relay and current trigger.
  - c. Closed-Open-Auto override switch located on the load side of relay.
2. Performance:
  - a. Ambient Temperature: Minus 30 to 140 deg F.
  - b. Voltage Rating: Single-phase loads rated for 300 V ac. Three-phase loads rated for 600 V ac.

3. Status Indication:
  - a. Current Sensor: Integral sensing for single-phase loads up to 20 A and external solid or split sensing ring for three-phase loads up to 150 A.
  - b. Current Sensor Range: As required by application.
  - c. Current Set Point: Adjustable .
  - d. Current Sensor Output:
    - 1) Solid-state, SPDT contact rated for 30 V ac and dc and for 0.4 A.
    - 2) Solid-state, SPDT contact rated for 120 V ac and 1.0 A.
    - 3) Analog, 0 to 5 or 10 V dc.
    - 4) Analog, 4 to 20 mA, loop powered.
4. Relay: SPDT, continuous-duty coil; rated for 10-million mechanical cycles.
5. Enclosure: NEMA 250, Type 1 enclosure for indoor applications; NEMA 250, Type 4 enclosure for outdoor applications.

## 2.12 ELECTRICAL POWER DEVICES

### A. Control Transformers:

1. Sizing Criteria: Size control transformers for total connected load, plus additional 25 percent of connected load for future spare capacity.
2. Transformer Minimum Capacity: 40 VA.
3. Protection: Provide transformers with both primary and secondary fuses. Integral circuit breaker is acceptable in lieu of fuses.
4. Enclosure: House control transformers in NEMA 250 enclosures, type as indicated in "Performance Requirements" Article for application.

### B. DC Power Supplies:

1. Description: Linear or switched, regulated power supplies with ac input to one or multiple dc output(s).
  - a. Include both line and load regulation to ensure stable output.
  - b. To protect both power supply and load, include power supply with an automatic current limiting circuit.
2. Features:
  - a. Connection: Plug-in style suitable for mating with standard 8-pin octal socket. Include power supply with mating mounting socket.
  - b. Housing: Enclose circuitry in a housing.
  - c. Local Adjustment: Include screw adjustment on exterior of housing for dc voltage output.
  - d. Mounting: DIN rail.
  - e. Visual status indicator.
3. Performance:
  - a. Input Voltage: Nominally 120 V ac, 60 Hz.
  - b. Output Voltage: Nominally 24 V dc with plus or minus 1 V dc adjustment.
  - c. Output Current: Minimum 100 mA.
  - d. Load Regulation: Within 0.1 percent.
  - e. Line Regulation: Within 0.05 percent.
  - f. Stability: Within 0.1 percent of rated volts after warmup period.
  - g. Ripple: 1 mV rms.

## 2.13 CONTROL WIRE AND CABLE

- A. Wire: Single conductor control wiring above 24 V.
  - 1. Wire Size: Minimum 18 AWG.
  - 2. Conductors: 7/24 soft annealed copper strand with 2- to 2.5-inch lay.
  - 3. Conductor Insulation: 600 V, Type THWN or Type THHN, and 90 deg C in accordance with UL 83.
  - 4. Conductor Insulation Colors: Black (hot), white (neutral), and green (ground).
  - 5. Furnish on spools.
- B. Single, Twisted-Shielded, Instrumentation Cable above 24 V:
  - 1. Wire Size: Minimum 18 AWG.
  - 2. Conductors: Twisted, 7/24 soft annealed copper strand with a 2- to 2.5-inch lay.
  - 3. Conductor Insulation: Type THHN/THWN or Type TFN rating.
  - 4. Conductor Insulation Colors:
    - a. Twisted Pair: Black and white.
    - b. Twisted Triad: Black, red, and white.
  - 5. Shielding: 100 percent type, 0.35/0.5-mil aluminum/Mylar tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
  - 6. Outer Jacket Insulation: 600 V, 90 deg C rating, and Type TC cable.
  - 7. Furnish on spools.
- C. Single, Twisted-Shielded, Instrumentation Cable 24 V and Less:
  - 1. Wire Size: Minimum 18 AWG.
  - 2. Conductors: Twisted, 7/24 soft annealed copper stranding with a 2- to 2.5-inch lay.
  - 3. Conductor Insulation: Nominal 15-mil thickness, constructed from flame-retardant PVC.
  - 4. Conductor Insulation Colors:
    - a. Twisted Pair: Black and white.
    - b. Twisted Triad: Black, red, and white.
  - 5. Shielding: 100 percent type, 1.35-mil aluminum/polymer tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
  - 6. Outer Jacket Insulation: 300 V, 105 deg C rating, and Type PLTC cable.
  - 7. Furnish on spools.
- D. LAN and Communication Cable: Comply with DDC system manufacturer requirements for network being installed.
  - 1. Comply with following requirements for balanced twisted pair cable described in Section 260523 "Control-Voltage Electrical Power Cables."
    - a. Plenum rated.
    - b. Unique color that is different from other cables used on Project.

## 2.14 IDENTIFICATION

- A. Control Equipment, Instruments, and Control Devices:

1. Laminated acrylic or melamine plastic sign bearing unique identification.
  - a. Include instruments with unique identification identified by equipment being controlled or monitored, followed by point identification.
2. Letter size as follows:
  - a. Servers: Minimum of 0.5 inch high.
  - b. DDC Controllers: Minimum of 0.5 inch high.
  - c. Gateways: Minimum of 0.5 inch high.
  - d. Repeaters: Minimum of 0.5 inch high.
  - e. Enclosures: Minimum of 0.5 inch high.
  - f. Electrical Power Devices: Minimum of 0.25 inch high.
  - g. UPS units: Minimum of 0.5 inch high.
  - h. Accessories: Minimum of 0.25 inch high.
  - i. Instruments: Minimum of 0.25 inch high.
  - j. Control Damper and Valve Actuators: Minimum of 0.25 inch high.
3. Engraved phenolic consisting of three layers of rigid laminate. Top and bottom layers color-coded black with contrasting white center exposed by engraving through outer layer.
4. Fastened with drive pins.
5. Instruments, control devices, and actuators with Project-specific identification tags having unique identification numbers following requirements indicated and provided by original manufacturer do not require additional identification.

B. Equipment Warning Labels:

1. Self-adhesive label with pressure-sensitive adhesive back and peel-off protective jacket.
2. Lettering size at least 14-point type with white lettering on red background.
3. Warning label to read "CAUTION-Equipment operated under remote automatic control and may start or stop at any time without warning. Switch electric power disconnecting means to OFF position before servicing."
4. Lettering to be enclosed in a white line border. Edge of label is to extend at least 0.25 inch beyond white border.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  1. Verify compatibility with and suitability of substrates.
- B. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.
- C. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.

- D. Examine walls, floors, roofs, and ceilings for suitable conditions where product will be installed.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 DDC SYSTEM INTERFACE WITH EXISTING SYSTEMS

- A. Integration with Existing Enterprise System:
  - 1. Interface DDC system with an existing enterprise system to adhere to Owner standards already in-place and to achieve integration.

### 3.3 CONTROL DEVICES FOR INSTALLATION BY INSTALLERS

- A. Deliver selected control devices, specified in indicated HVAC instrumentation and control device Sections, to identified equipment and systems manufacturers for factory installation and to identified installers for field installation.

### 3.4 GENERAL INSTALLATION REQUIREMENTS

- A. Install products to satisfy more stringent of all requirements indicated.
- B. Install products level, plumb, parallel, and perpendicular with building construction.
- C. If codes and referenced standards are more stringent than requirements indicated, comply with requirements in codes and referenced standards.
- D. Fabricate openings and install sleeves in ceilings, floors, roof, and walls required by installation of products. Before proceeding with drilling, punching, and cutting, check for concealed work to avoid damage. Patch, flash, grout, seal, and refinish openings to match adjacent condition.
- E. Firestop Penetrations Made in Fire-Rated Assemblies: Comply with requirements in Section 078413 "Penetration Firestopping."
- F. Seal penetrations made in acoustically rated assemblies. Comply with requirements in Section 079200 "Joint Sealants."
- G. Fastening Hardware:
  - 1. Wrenches, pliers, and other tools that damage surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening fasteners.
  - 2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
  - 3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

- H. If product locations are not indicated, install products in locations that are accessible and that will permit service and maintenance from floor, equipment platforms, or catwalks without removal of permanently installed furniture and equipment.

### 3.5 INSTALLATION OF CONTROLLERS

- A. Install controllers in enclosures to comply with indicated requirements.
- B. Connect controllers to field power supply.
- C. Install controllers with latest version of applicable software and configure to execute requirements indicated.
- D. Test and adjust controllers to verify operation of connected I/O to achieve performance indicated requirements while executing sequences of operation.
- E. Installation of Network Controllers:
  - 1. DDC system provider and DDC system manufacturer to determine quantity and location of network controllers to satisfy requirements indicated.
  - 2. Install controllers in a protected location that is easily accessible by operators.
- F. Installation of Programmable Application Controllers:
  - 1. DDC system provider and DDC system manufacturer to determine quantity and location of programmable application controllers to satisfy requirements indicated.
  - 2. Install controllers in a protected location that is easily accessible by operators.
- G. Application-Specific Controllers:
  - 1. DDC system provider and DDC system manufacturer to determine quantity and location of application-specific controllers to satisfy requirements indicated.
  - 2. For controllers not mounted directly on equipment being controlled, install controllers in a location that is easily accessible by operators.

### 3.6 INSTALLATION OF ENCLOSURES

- A. Install the following items in enclosures, to comply with indicated requirements:
  - 1. Controllers.
  - 2. Electrical power devices.
  - 3. Relays.
  - 4. Accessories.
  - 5. Instruments.
  - 6. Actuators.
- B. Attach wall-mounted enclosures to wall using the following types of steel struts:

1. For NEMA 250, Type 1 Enclosures: Use corrosion-resistant-coated steel strut and hardware.
  2. Install plastic caps on exposed cut edges of strut.
- C. Align top or bottom of adjacent enclosures of like size.
- D. Install continuous and fully accessible wireways to connect conduit, wire, and cable to multiple adjacent enclosures. Wireways used for application are to have protection equal to NEMA 250 rating of connected enclosures.

### 3.7 ELECTRIC POWER CONNECTIONS

- A. Connect electrical power to DDC system products requiring electrical power connections.
- B. Design of electrical power to products not indicated with electric power is delegated to DDC system provider and installing trade to provide a fully functioning DDC system. Work is to comply with NFPA 70 and other requirements indicated.
- C. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers" for electrical power circuit breakers.
- D. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical power conductors and cables.
- E. Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems" for electrical power raceways and boxes.

### 3.8 INSTALLATION OF IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements in Section 260553 "Identification for Electrical Systems" for identification products and installation.
- B. Install unique instrument identification for each instrument connected to DDC controller.
- C. Install unique identification for each control damper and valve actuator connected to DDC controller.
- D. Where product is installed above accessible tile ceiling, also install matching identification on face of ceiling grid located directly below.
- E. Where product is installed above an inaccessible ceiling, also install identification on face of access door directly below.

### 3.9 INSTALLATION OF NETWORKS

- A. Install balanced twisted pair cable when connecting between the following network devices located in same building:
  - 1. Network controllers.
- B. Install balanced twisted pair or copper cable (as required by equipment) when connecting between the following:
  - 1. Network controllers and programmable application controllers.
  - 2. Programmable application controllers.
  - 3. Programmable application controllers and application-specific controllers.
  - 4. Application-specific controllers.

### 3.10 NETWORK NAMING AND NUMBERING

- A. Coordinate with Owner and provide unique naming and addressing for networks and devices.

### 3.11 INSTALLATION OF CONTROL WIRE, CABLE, AND RACEWAY

- A. Comply with NECA 1.
- B. Wire and Cable Installation:
  - 1. Comply with installation requirements in Section 260523 "Control-Voltage Electrical Power Cables."
  - 2. Install cables with protective sheathing that is waterproof and capable of withstanding continuous temperatures of 90 deg C with no measurable effect on physical and electrical properties of cable.
    - a. Provide shielding to prevent interference and distortion from adjacent cables and equipment.
  - 3. Terminate wiring in a junction box.
    - a. Clamp cable over jacket in a junction box.
    - b. Individual conductors in the stripped section of cable is to be slack between the clamping point and terminal block.
  - 4. Terminate field wiring and cable not directly connected to instruments and control devices having integral wiring terminals using terminal blocks.
  - 5. Install signal transmission components in accordance with IEEE C2, REA Form 511a, NFPA 70, and as indicated.
  - 6. Use shielded cable to transmitters.
  - 7. Use shielded cable to temperature sensors.
  - 8. Perform continuity and meager testing on wire and cable after installation.
- C. Conduit Installation:
  - 1. Comply with Section 260533 "Raceway and Boxes for Electrical Systems" for control-voltage conductors.

2. Comply with Section 270528 "Pathways for Communications Systems" for balanced twisted pair cabling and optical fiber installation.

### 3.12 FIELD QUALITY CONTROL

- A. Testing Agency: a qualified testing agency to perform tests and inspections.

### 3.13 DDC SYSTEM I/O CHECKOUT PROCEDURES

- A. Check installed products before continuity tests, leak tests, and calibration.
- B. Check instruments for proper location and accessibility.
- C. Check instruments for proper installation on direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.
- D. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material, and support.
- E. Control Damper Checkout:
  1. Verify that control dampers are installed correctly for flow direction.
  2. Verify that proper blade alignment, either parallel or opposed, has been provided.
  3. Verify that damper frame attachment is properly secured and sealed.
  4. Verify that damper actuator and linkage attachment are secure.
  5. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
  6. Verify that damper blade travel is unobstructed.
- F. Instrument Checkout:
  1. Verify that instrument is correctly installed for location, orientation, direction, and operating clearances.
  2. Verify that attachment is properly secured and sealed.
  3. Verify that conduit connections are properly secured and sealed.
  4. Verify that wiring is properly labeled with unique identification, correct type, and size and is securely attached to proper terminals.
  5. Inspect instrument tag against approved submittal.
  6. For instruments with tubing connections, verify that tubing attachment is secure and isolation valves have been provided.
  7. For flow instruments, verify that recommended upstream and downstream distances have been maintained.
  8. For temperature instruments, verify the following:
    - a. Sensing element type and proper material.
    - b. Length and insertion.

### 3.14 DDC SYSTEM I/O ADJUSTMENT, CALIBRATION, AND TESTING

- A. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.
- B. For each analog instrument, make three-point test of calibration for both linearity and accuracy.
- C. Equipment and procedures used for calibration to comply with instrument manufacturer's written instructions.
- D. Calibrate each instrument in accordance with instruction manual supplied by instrument manufacturer.
- E. If after calibration the indicated performance cannot be achieved, replace out-of-tolerance instruments.
- F. Analog Signals:
  - 1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
  - 2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
  - 3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.
- G. Digital Signals:
  - 1. Check digital signals using a jumper wire.
  - 2. Check digital signals using an ohmmeter to test for contact making or breaking.
- H. Control Dampers:
  - 1. Stroke and adjust control dampers following manufacturer's recommended procedure, from 100 percent open to 100 percent closed and back to 100 percent open.
  - 2. Check and document open and close cycle times for applications with cycle time less than 30 seconds.
  - 3. For control dampers equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.
- I. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.
- J. Switches: Calibrate switches to make or break contact at set points indicated.
- K. Transmitters:
  - 1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
  - 2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistant source.

### 3.15 DDC SYSTEM CONTROLLER CHECKOUT

- A. Verify power supply.
  - 1. Verify voltage, phase, and hertz.
  - 2. Verify that protection from power surges is installed and functioning.
  - 3. Verify that ground fault protection is installed.
- B. Verify that wire and cabling are properly secured to terminals and labeled with unique identification.
- C. Verify that spare I/O capacity is provided.

### 3.16 DDC CONTROLLER I/O CONTROL LOOP TESTS

- A. Testing:
  - 1. Test every I/O point connected to DDC controller to verify that safety and operating control set points are as indicated and as required to operate controlled system safely and at optimum performance.
  - 2. Test every I/O point throughout its full operating range.
  - 3. Test every control loop to verify that operation is stable and accurate.
  - 4. Adjust control loop proportional, integral, and derivative settings to achieve optimum performance while complying with performance requirements indicated. Document testing of each control loop's precision and stability via trend logs.
  - 5. Test and adjust every control loop for proper operation according to sequence of operation.
  - 6. Test software and hardware interlocks for proper operation. Correct deficiencies.
  - 7. Operate each analog point at the following:
    - a. Upper quarter of range.
    - b. Lower quarter of range.
    - c. At midpoint of range.
  - 8. Exercise each binary point.

END OF SECTION

## SECTION 230923.11 CONTROL VALVES

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Ball-style control valves
2. Electric and electronic control valve actuators.

##### B. Related Requirements:

1. Section 230923 "Direct Digital Control (DDC) System for HVAC" control equipment and software, relays, electrical power devices, uninterruptible power supply units, wire, and cable.

#### 1.2 GENERAL REQUIREMENTS FOR THIS PROJECT

- ##### A.
- Refer to Drawings for Additional Information, particularly the Sequence of Operations, coil/valve details and piping schematics.

#### 1.3 DEFINITIONS

- ##### A.
- Cv: Valve coefficient.
- ##### B.
- DDC: Direct digital control.
- ##### C.
- EPT: Ethylene-propylene terpolymer rubber.
- ##### D.
- HNBR: Hydrogenated nitrile butadiene rubber.
- ##### E.
- NBR: Nitrile butadiene rubber.
- ##### F.
- PEEK: Polyether Ether Ketone rubber.
- ##### G.
- PTFE: Polytetrafluoroethylene.
- ##### H.
- RMS: Root-mean-square value of alternating voltage, which is the square root of the mean value of the square of the voltage values during a complete cycle.
- ##### I.
- RTFE: Glass-fiber-reinforced PTFE.
- ##### J.
- TFM: A chemically modified PTFE.

#### 1.4 ACTION SUBMITTALS

##### A. Product Data:

1. Ball-style control valves.

2. Electric and electronic control valve actuators.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For control valves.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- C. ASME Compliance: Fabricate and label products to comply with ASME Boiler and Pressure Vessel Code where required by authorities having jurisdiction.
- D. Code Compliance: Comply with governing energy code.
- E. Ground Fault: Properly ground products to prevent failing due to ground fault conditions.
- F. Environmental Conditions: For actuators not available with integral enclosures complying with requirements indicated, house in protective secondary enclosures complying with requirements.
- G. Sizing Criteria: Unless otherwise indicated, select control valve size using the following:
  1. ISA Standards:
    - a. Control Valve Sizes and Flow Coefficients: ISA 75.01.01.
    - b. Control Valve Characteristics and Rangeability: ISA 75.11.01.
  2. Correction Factors: Consider viscosity, flashing, and cavitation corrections when selecting control valves.
  3. Ball-Style Control Valves: Select valve size with design Cv at design flow between 65 and 75 degrees of valve full open position and minimum Cv between 15 and 25 percent of open position.
  4. Modulating Control Valves in Hydronic Systems:
    - a. Select modulating control valve sizes at terminal equipment for a design Cv based on a pressure drop of 5 psig at design flow.

## 2.2 BALL-STYLE CONTROL VALVES

### A. Ball Valves with Threaded Ends, Three Way Mixing:

1. Source Limitations: Obtain threaded end three-way ball valves from single manufacturer.
2. Three way mixing, characterized control valve.
3. Performance:
  - a. Controllable Flow Range: 75 percent open.
  - b. Flow Characteristic: A-port (from coil): equal percentage; B-port (from supply: modified for constant common port flow.
  - c. Leakage: FCI 70-2, Class III or less
  - d. Hydronic Pressure:
    - 1) Rating for Sizes NPS 1-1/4 and Smaller: Nominal 600 psig.
    - 2) Close-off Pressure: 200 psig .
    - 3) Pressure Differential (Maximum): 50 psig .
  - e. Hydronic Process Temperature Range: 0 to 250 deg F .
4. Construction for Ball Valves with Threaded Ends, Three Way:
  - a. Size Range: NPS 1/2 to NPS 2.
  - b. Body: Nickel-plated brass body.
  - c. End Connections: Female threaded (NPT) ends.
  - d. Ball: Stainless steel.
  - e. Ball Seats: Reinforced PTFE.
  - f. Stem and Stem Extension:
    - 1) Material to match ball.
    - 2) For valves installed in insulated piping systems, provide stem extension extending beyond OD of insulation.
  - g. Stem Seal: Reinforced PTFE packing ring with a threaded packing ring follower to retain the packing ring under design pressure with the linkage removed. Alternative means, such as EPDM O-rings, are acceptable if an equivalent cycle endurance can be demonstrated by testing.

## 2.3 ELECTRIC AND ELECTRONIC CONTROL VALVE ACTUATORS

- A. Furnish control valves with factory-installed actuators from control valve manufacturer. Actuators manufactured by listed control valve manufacturers are acceptable subject to compliance with requirements.
- B. Type: Motor operated, with gears, electric and electronic.
- C. Voltage: 24 Volt; Actuator shall deliver torque required for continuous uniform movement of controlled device from limit to limit when operated at rated voltage and temperatures.
- D. Construction:
  - 1. Less Than 100 W: Fiber or reinforced nylon gears with steel shaft, copper alloy or nylon bearings, and pressed steel enclosures.
- E. Local Field Adjustment: Make spring-return actuators easily switchable from fail-safe open to fail-safe closed in the field without replacement.
- F. Local Manual Override: Provide gear-type actuators with an external manual adjustment mechanism to allow manual positioning of the damper when the actuator is not powered.
- G. Modulating Actuators:
  - 1. Capable of stopping at all points across full range, and starting in either direction from any point in range.
  - 2. Control Input Signal:
    - a. Programmable Multifunction:
      - 1) Control input, position feedback, and running time are to be factory or field programmable.
      - 2) Diagnostic feedback of hunting or oscillation, mechanical overload, mechanical travel, and mechanical load limit.
      - 3) Service data, including at a minimum, number of hours powered and number of hours in motion.
  - 3. Position Feedback: Equip modulating actuators with analog position feedback through voltage signal for remote monitoring.
- H. Fail-Safe:
  - 1. Provide actuator to fail to an end position.
  - 2. Internal spring-return mechanism to drive controlled device to an end position (open to coil) on loss of power.

I. Integral Overload Protection:

1. Provide against overload throughout the entire operating range in both directions.

J. Valve Attachment:

1. Unless otherwise required for valve interface, provide an actuator designed to be directly coupled to valve stem without the need for connecting linkages.
2. Attach actuator to valve drive shaft in a way that ensures maximum transfer of power and torque without slippage.
3. Bolt and set screw method of attachment is acceptable only if provided with at least two points of attachment.

K. Temperature and Humidity:

1. Temperature: Suitable for operating temperature range encountered by application with minimum operating temperature range of minus 20 to plus 120 deg F .
2. Humidity: Suitable for humidity range encountered by application; minimum operating range is to be from 5 to 95 percent relative humidity, noncondensing.

L. Enclosure:

1. Suitable for ambient conditions encountered by application.
2. NEMA, Type 2 for indoor applications.

M. Stroke Time:

1. Select operating stroke time to be compatible with equipment and system operation .
  - a. Operate valve from fully closed to fully open position within 15 seconds.
  - b. Move valve to fail-safe position within 5 seconds.

N. Sound: Where actuators are located in tenant-occupied rooms with a room sound level criteria of NC-35 or lower, comply with the following sound levels:

1. Spring Return: 45 dBA.
2. Nonspring Return: 45 dBA.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. Examine roughing-in for valves installed in piping to verify actual locations of piping connections before installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Provide 3-way control valve for each VAV/Terminal unit hot water coil.
- B. Furnish and install products required to satisfy most stringent requirements indicated.
- C. Install products level, plumb, parallel, and perpendicular with building construction.
- D. Properly support control valves and actuators, tubing, piping, wiring, and conduits to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment when subjected to a seismic event, wind, or others forces common to the application.
- E. Provide ceiling, floor, roof, and wall openings and sleeves required by installation. Before proceeding with drilling, punching, or cutting, check location first for concealed products that could potentially be damaged. Patch, flash, grout, seal, and refinish openings to match adjacent condition.
- F. Seal penetrations made in fire-rated and acoustically rated assemblies.
- G. Fastening Hardware:
  - 1. Wrenches, pliers, and other tools that will cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for assembling and tightening nuts.
  - 2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
  - 3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.
- H. Install products in locations that are accessible and that will permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

### 3.3 CONTROL VALVES

- A. Install pipe reducers for control valves smaller than line size. Position reducers as close to control valve as possible but at distance to avoid interference and impact to performance. Install with manufacturer-recommended clearance.
- B. Install flanges or unions to allow drop-in and -out valve installation.

- C. Test Plugs: Install pressure temperature test plugs in piping upstream and downstream of each control valve larger than 1/2 inch. .
- D. Valve Orientation:
  - 1. Where possible, install ball valves that are installed in horizontal piping, with stems upright and not more than 15 degrees off of vertical, not inverted.
  - 2. Install valves in a position to allow full stem movement.
- E. Clearance:
  - 1. Locate valves for easy access, and provide separate support of valves that cannot be handled by service personnel without hoisting mechanism.
  - 2. Install valves with at least 12 inches of clear space around valve and between valves and adjacent surfaces.
- F. Threaded Valves:
  - 1. Note internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.
  - 2. Align threads at point of assembly.
  - 3. Apply thread compound to external pipe threads, except where dry seal threading is specified.
  - 4. Assemble joint, wrench tight. Apply wrench on valve end as pipe is being threaded.

### 3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Use same designation at each end for each piece of wire, cable, and tubing for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Install engraved phenolic nameplate with valve identification on valve and on face of ceiling directly below valves concealed above ceilings. Comply with requirements in Section 230923 "Direct Digital Control (DDC) System for HVAC."

### 3.5 ELECTRICAL CONNECTIONS

- A. Install electrical power to field-mounted control devices requiring electrical power.
- B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260523 "Control-Voltage Electrical Power Cables."
- C. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

- D. Furnish and install raceways. Comply with requirements in Section 260533.13 "Conduits for Electrical Systems."
- E. Furnish and install circuit breakers. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers."
- F. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
- G. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
  - 1. Nameplate to be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
  - 2. Nameplate to be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

### 3.6 CONTROL CONNECTIONS

- A. Install control signal wiring to field-mounted control devices.
- B. Connect control signal wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."
- C. Furnish and install raceways. Comply with requirements in Section 260533.13 "Conduits for Electrical Systems."

### 3.7 CLEANING

- A. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from exposed surfaces.

### 3.8 ADJUSTMENT, CALIBRATION, AND TESTING

- A. Stroke and adjust control valves following manufacturer's recommended procedure, from 100 percent open to 100 percent closed back to 100 percent open.
- B. Check and document open and close cycle times for applications with a cycle time of less than 15 seconds.
- C. For control valves equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

END OF SECTION

SECTION 230923.27  
TEMPERATURE INSTRUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Air temperature sensors.

B. Related Requirements:

1. Section 230923 "Direct-Digital Control System for HVAC" for control equipment and software, relays, electrical power devices, uninterruptible power supply units, wire, and cable.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Environmental Conditions:

1. Instruments shall operate without performance degradation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified and encountered for installed location.
2. Instruments and accessories shall be protected with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Instruments not available with integral enclosures complying with requirements indicated shall be housed in protective secondary enclosures. Instrument's installed location shall dictate following NEMA 250 enclosure requirements:
  - a. Outdoors, Protected: Type 2 .
  - b. Outdoors, Unprotected: Type 4 .
  - c. Indoors, Heated with Filtered Ventilation: Type 1 .
  - d. Indoors, Heated with Non-Filtered Ventilation: Type 2 .
  - e. Indoors, Heated and Air Conditioned: Type 1 .
  - f. Mechanical Equipment Rooms:
    - 1) Chiller and Boiler Rooms: Type 4 .
  - g. Within Duct Systems and Air-Moving Equipment Not Exposed to Possible Condensation: Type 2 .

## 2.2 AIR TEMPERATURE SENSORS

### A. Platinum RTDs: Common Requirements:

1. 100 or 1000 ohms at 0 deg C and a temperature coefficient of 0.00385 ohm/ohm/deg C.
2. Two-wire, PTFE-insulated, 22-gage stranded copper leads.
3. Performance Characteristics:
  - a. Range: Minus 50 to 275 deg F.
  - b. Interchangeable Accuracy: At 32 deg F within 0.5 deg F.
  - c. Repeatability: Within 0.5 deg F.
  - d. Self-Heating: Negligible.
4. Transmitter Requirements:
  - a. Transmitter required for each 100-ohm RTD.
  - b. Transmitter optional for 1000-ohm RTD, contingent on compliance with end-to-end control accuracy.

### B. Platinum RTD, Single-Point Air Temperature Duct Sensors:

1. 100 or 1000 ohms.
2. Temperature Range: Minus 50 to 275 deg F.
3. Probe: Single-point sensor with a stainless steel sheath.
4. Length: As required by application to achieve tip at midpoint of air tunnel, up to 18 inches long.
5. Enclosure: Junction box with removable cover; NEMA 250, Type 1 for indoor applications and Type 4 for outdoor applications.
6. Gasket for attachment to duct or equipment to seal penetration airtight.
7. Conduit Connection: 1/2-inch trade size.

### C. Platinum RTD, Air Temperature Averaging Sensors:

1. 100 or 1000 ohms.
2. Temperature Range: Minus 50 to 275 deg F.
3. Multiple sensors to provide average temperature across entire length of sensor.

4. Rigid probe of aluminum, brass, copper, or stainless steel sheath.
5. Flexible probe of aluminum, brass, copper, or stainless steel sheath and formable to a 4-inch radius.
6. Length: As required by application to cover entire cross section of air tunnel.
7. Enclosure: Junction box with removable cover; NEMA 250, Type 1 for indoor applications and Type 4 for outdoor applications.
8. Gasket for attachment to duct or equipment to seal penetration airtight.
9. Conduit Connection: 1/2-inch trade size.

D. Platinum RTD Outdoor Air Temperature Sensors:

1. 100 or 1000 ohms.
2. Temperature Range: Minus 50 to 275 deg F.
3. Probe: Single-point sensor with a stainless steel sheath.
4. Solar Shield: Stainless steel.
5. Enclosure: NEMA 250, Type 4 or 4X junction box or combination conduit and outlet box with removable cover and gasket.
6. Conduit Connection: 1/2-inch trade size.

E. Platinum RTD Space Air Temperature and Humidity Sensors:

1. 100 or 1000 ohms.
2. Temperature Range: Minus 50 to 212 deg F.
3. Humidity range: 10-90% RH
4. Sensor assembly shall include a temperature sensing element mounted under a bright white, non-yellowing, plastic cover.
5. Provide a mounting plate that is compatible with the surface shape that it is mounted to and electrical box used.
6. Concealed wiring connection.

## PART 3 - EXECUTION

### 3.1 TEMPERATURE INSTRUMENT APPLICATIONS

A. Liquid Temperature Sensors:

1. Heating Water System: Liquid temperature sensor, commercial grade.

### 3.2 ELECTRICAL CONNECTIONS

- A. Furnish and install electrical power to products requiring electrical connections.
- B. Furnish and install circuit breakers. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers."
- C. Furnish and install power wiring. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- D. Furnish and install raceways. Comply with requirements in Section 260533.13 "Conduits for Electrical Systems."

### 3.3 INSTALLATION OF TEMPERATURE INSTRUMENTS

#### A. Mounting Location:

##### 1. Roughing In:

- a. Outline instrument mounting locations before setting instruments and routing cable, wiring, tubing, and conduit to final location.
  - b. Provide independent inspection to confirm that proposed mounting locations comply with requirements indicated and approved submittals.
    - 1) Indicate dimensioned locations with mounting height for all surface-mounted products on Shop Drawings.
    - 2) Do not begin installation without submittal approval of mounting location.
  - c. Complete installation rough-in only after confirmation by independent inspection is complete and approval of location is documented for review by Owner and Architect on request.
- 2. Install switches and transmitters for air and liquid temperature associated with individual air-handling units and associated connected ductwork and piping near air-handling units co-located in air-handling unit system control panel to provide service personnel a single and convenient location for inspection and service.
  - 3. Install liquid temperature switches and transmitters for indoor applications in mechanical equipment rooms. Do not locate in user-occupied space unless indicated specifically on Drawings.
  - 4. Install air temperature switches and transmitters for indoor applications in mechanical equipment rooms. Do not locate in user-occupied space unless indicated specifically on Drawings.
  - 5. Mount switches and transmitters on walls, floor-supported freestanding pipe stands, or floor-supported structural support frames. Use manufacturer's mounting brackets to accommodate field mounting. Securely support and brace products to prevent vibration and movement.

B. Special Mounting Requirements:

1. Protect products installed outdoors from solar radiation, building and wind effect with stand-offs and shields constructed of Type 316 stainless .
2. Temperature instruments having performance impacted by temperature of mounting substrate shall be isolated with an insulating barrier located between instrument and substrate to eliminate effect. Where instruments requiring insulation are located in finished space, conceal insulating barrier in a cover matching the instrument cover.

C. Mounting Height:

1. Mount temperature instruments in user-occupied space to match mounting height of light switches unless otherwise indicated on Drawings. Mounting height shall comply with codes and accessibility requirements.
2. Mount switches and transmitters located in mechanical equipment rooms and other similar space not subject to code or state and Federal accessibility requirements within a range of 42 to 72 inches above the adjacent floor, grade, or service catwalk or platform.
  - a. Make every effort to mount at 48 inches.

D. Seal penetrations to ductwork, plenums, and air-moving equipment to comply with duct static-pressure class and leakage and seal classes indicated using neoprene gaskets or grommets.

E. Space Temperature Sensor Installation:

1. Conceal assembly in an electrical box of sufficient size to house sensor and transmitter, if provided.
2. Install electrical box with a faceplate to match sensor cover if sensor cover does not completely cover electrical box.
3. In finished areas, recess electrical box within wall.
4. In unfinished areas, electrical box may be surface mounted if electrical light switches are surface mounted. Use a cast-aluminum electric box for surface-mounted installations.
5. Align electrical box with other electrical devices such as visual alarms and light switches located in the vicinity to provide a neat and well-thought-out arrangement. Where possible, align in both horizontal and vertical axis.

F. Outdoor Air Temperature Sensor Installation:

1. Mount sensor in a discrete location facing north.
2. Protect installed sensor from solar radiation and other influences that could impact performance.

3. If required to have a transmitter, mount transmitter remote from sensor in an accessible and serviceable location indoors.

G. Single-Point Duct Temperature Sensor Installation:

1. Install single-point-type, duct-mounted, supply- and return-air temperature sensors. Install sensors in ducts with sensitive portion of the element installed in center of duct cross section and located to sense near average temperature. Do not exceed 24 inches in sensor length.
2. Install return-air sensor in location that senses return-air temperature without influence from outdoor or mixed air.
3. Rigidly support sensor to duct and seal penetration airtight.
4. If required to have transmitter, mount transmitter remote from sensor at accessible and serviceable location.

H. Averaging Duct Temperature Sensor Installation:

1. Install averaging-type air temperature sensor for temperature sensors located within air-handling units, similar equipment, and large ducts with air tunnel cross-sectional area of 20 sq. ft. and larger.
2. Install sensor length to maintain coverage over entire cross-sectional area. Install multiple sensors where required to maintain the minimum coverage.
3. Fasten and support sensor with manufacturer-furnished clips to keep sensor taut throughout entire length.
4. If required to have transmitter, mount transmitter in an accessible and serviceable location.

### 3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Install engraved phenolic nameplate with instrument identification.

### 3.5 CLEANING

- A. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from exposed interior and exterior surfaces.
- B. Wash and shine glazing.
- C. Polish glossy surfaces to a clean shine.

### 3.6 CHECK-OUT PROCEDURES

- A. Check installed products before continuity tests, leak tests, and calibration.
- B. Check temperature instruments for proper location and accessibility.
- C. Verify sensing element type and proper material.
- D. Verify location and length.
- E. Verify that wiring is correct and secure.

END OF SECTION

SECTION 232113  
HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Copper tube and fittings.
  2. Steel pipe and fittings.
  3. Piping joining materials.
  4. Dielectric fittings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
1. Pipe and tube.
  2. Fittings.
  3. Joining materials.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation are to be capable of withstanding the following minimum working pressures and temperatures unless otherwise indicated:
1. Hot-Water Heating Piping: 100 psig at 200 deg F .

2.2 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tube: ASTM B88, Type K .
- B. Annealed-Temper Copper Tube: ASTM B88, Type K .
- C. DWV Copper Tube: ASTM B306, Type DWV.
- D. Cast-Copper, Solder-Joint Fittings: ASME B16.18 pressure fittings. Do not use solder joints on pipe sizes greater than NPS 4.
- E. Wrought-Copper, Solder-Joint Fittings: ASME B16.22 pressure fittings. Do not use solder joints on pipe sizes greater than NPS 4.
- F. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Do not use solder joints on pipe sizes greater than NPS 4.

- G. Cast-Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends. Do not use solder joints on pipe sizes greater than NPS 4.
- H. Wrought-Copper Unions: ASME B16.22. Do not use solder joints on pipe sizes greater than NPS 4.
- I. Copper-Tube, Mechanically Formed Tee Fitting: For forming T-branch on copper water tube.
  - 1. Description: Tee formed in copper tube in accordance with ASTM F2014.
- J. Grooved, Mechanical-Joint, Copper Tube Appurtenances:
  - 1. Source Limitations: Obtain grooved mechanical-joint copper tube appurtenances from single manufacturer.
  - 2. Grooved-End Copper Fittings: ASTM B75 copper tube or ASTM B584 bronze castings.
  - 3. Grooved-End-Tube Couplings: To fit copper-tube dimensions; rigid pattern unless otherwise indicated; gasketed fitting EPDM gasket rated for minimum 230 deg F for use with ferrous housing, and steel bolts and nuts; 300 psig minimum CWP pressure rating.
- K. Copper-Tube, Pressure-Seal-Joint Fittings - Copper or Bronze:
  - 1. Source Limitations: Obtain copper-tube pressure-seal-joint fittings from single manufacturer.
  - 2. Housing: Copper or bronze.
  - 3. O-Rings and Pipe Stops: EPDM.
  - 4. Tools: Manufacturer's special tools.
  - 5. Minimum 200 psig working pressure rating at 250 deg F.

## 2.3 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A53/A53M black steel with plain ends; welded and seamless, Grade B, and schedule number as indicated in Part 3, "Piping Applications" Article.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3, "Piping Applications" Article.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3, "Piping Applications" Article.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3, "Piping Applications" Article.

- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.
- F. Wrought-Steel Fittings: ASTM A234/A234M; wall thickness to match adjoining pipe.
- G. Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
  - 1. Material Group: 1.1.
  - 2. End Connections: Butt welding.
  - 3. Facings: Raised face.
- H. Grooved Mechanical-Joint Fittings and Couplings:
  - 1. Source Limitations: Obtain grooved mechanical-joint fittings and couplings from single manufacturer.
  - 2. Joint Fittings: ASTM A536, Grade 65-45-12 ductile iron; ASTM A47/A47M, Grade 32510 malleable iron; ASTM A53/A53M, Type F, E, or S, Grade B fabricated steel; or ASTM A106/A106M, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
  - 3. Couplings: Ductile- or malleable-iron housing and EPDM or nitrile gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
- I. Plain-End Mechanical-Joint Couplings:
  - 1. Source Limitations: Obtain plain-end mechanical-joint couplings from single manufacturer.
  - 2. Housing: ASTM A536, Grade 65-45-12 segmented ductile iron or Type 304 stainless steel.
  - 3. Housing coating: None .
  - 4. Gasket: EPDM .
  - 5. Sealing Mechanism: Double-lip sealing system or carbon steel case-hardened jaws.
  - 6. Bolts, hex nuts, washers, or lock bars based on manufacturer's design.
  - 7. Minimum Pressure Rating: Equal to that of the joined pipes.
- J. Steel Pipe Nipples: ASTM A733, made of same materials and wall thicknesses as pipe in which they are installed.

## 2.4 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B32, lead-free alloys.
- D. Flux: ASTM B813, water flushable.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
- F. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for CPVC Piping: ASTM F493.
- H. Solvent Cements for PVC Piping: ASTM D2564. Include primer in accordance with ASTM F656.

## 2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  - 1. Source Limitations: Obtain dielectric unions from single manufacturer.
  - 2. Description:
    - a. Standard: ASSE 1079.
    - b. Pressure Rating: 125 psig minimum at 180 deg F .
    - c. End Connections: Solder-joint copper alloy and threaded ferrous. Solder joints are not to be used on pipe sizes greater than NPS 4.
- C. Dielectric Flanges:
  - 1. Source Limitations: Obtain dielectric flanges from single manufacturer.

2. Description:
  - a. Standard: ASSE 1079.
  - b. Factory-fabricated, bolted, companion-flange assembly.
  - c. Pressure Rating: 125 psig minimum at 180 deg F .
  - d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric Nipples:

1. Source Limitations: Obtain dielectric nipples from single manufacturer.
2. Description:
  - a. Standard: IAPMO PS 66.
  - b. Electroplated steel nipple, complying with ASTM F1545.
  - c. Pressure Rating: Minimum 300 psig at 225 deg F .
  - d. End Connections: Male threaded or grooved.
  - e. Lining: Inert and noncorrosive, propylene.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Hot-Water Heating Piping, Aboveground, NPS 2 (DN 50) and Smaller, to Be Any of the Following:
  1. Type K , drawn-temper copper tubing, wrought-copper fittings, and soldered brazed pressure-seal grooved mechanical joints.
  2. Schedule 40 , Grade B, steel pipe; Class 125, cast-iron Class 150, malleable-iron fittings; and threaded grooved mechanical joints.
- B. Hot-Water Heating Piping, Aboveground, NPS 2-1/2 (DN 65) and Larger, to Be Any of the Following:
  1. Type K , drawn-temper copper tubing, wrought-copper fittings, and soldered brazed grooved mechanical joints.
  2. Schedule 40 , Grade B, steel pipe; grooved mechanical joint coupling and fittings; and grooved mechanical joints.
  3. Schedule 40 , Grade B, steel pipe, plain-end mechanical joint couplings and fittings; and plain-end mechanical joints.

### 3.2 INSTALLATION OF PIPING

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install air vents and pressure-relief valves in accordance with Section 232116 "Hydronic Piping Specialties."
- Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install shutoff valve immediately upstream of each dielectric fitting.

### 3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Soldered Joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints in accordance with ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B32.
- D. Brazed Joints: Construct joints in accordance with AWS's "Brazing Handbook," "Pipe and Tube" chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.
- E. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.
- H. Plain-End Mechanical-Coupled Joints: Prepare, assemble, and test joints in accordance with manufacturer's written installation instructions.

### 3.4 INSTALLATION OF DIELECTRIC FITTINGS

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric nipples unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges .

### 3.5 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.

- B. Install hangers for copper tubing and steel piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- C. Support horizontal piping within 12 inches of each fitting and coupling.
- D. Support vertical runs of copper tubing and steel piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

### 3.6 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections are to be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.

END OF SECTION

SECTION 232116  
HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hydronic specialty valves.
2. Air vents.
3. Strainers.
4. Flexible connectors.

B. Related Requirements:

1. Section 230523.12 "Ball Valves for HVAC Piping" for specification and installation requirements for ball valves common to most piping systems.
2. Section 230523.13 "Butterfly Valves for HVAC Piping" for specification and installation requirements for butterfly valves common to most piping systems.
3. Section 230523.14 "Check Valves for HVAC Piping" for specification and installation requirements for check valves common to most piping systems.
4. Section 230923.11 "Control Valves" for automatic control valve and sensor specifications, installation requirements, and locations.

1.2 SPECIAL REQUIREMENTS FOR THIS PROJECT

- A. Refer to Drawings for Additional Information, particularly the Equipment Schedules and Piping Schematics.
- B. Provide threaded hose fittings for all manual air vents.
- C. Provide manual balancing valves or automatic flow control valves for balancing VAV Terminal Units.
- D. Provide manual balancing valves for hydronic piping coils serving air handling unit.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product:

1. Include construction details and material descriptions for hydronic piping specialties.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

3. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For hydronic piping specialties to include in emergency, operation, and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

### PART 2 - PRODUCTS

#### 2.1 HYDRONIC SPECIALTY VALVES

##### A. Bronze, Calibrated-Orifice, Balancing Valves:

1. Body: Bronze, ball or plug type with calibrated orifice or venturi.
2. Ball: Brass or stainless steel.
3. Plug: Resin.
4. Seat: PTFE.
5. End Connections: Threaded or socket.
6. Pressure Gauge Connections: Integral seals for portable differential pressure meter.
7. Handle Style: Lever, with memory stop to retain set position.
8. CWP Rating: Minimum 125 psig.
9. Maximum Operating Temperature: 250 deg F.

##### B. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:

1. Body: Cast-iron or steel body, ball, butterfly, plug, or globe pattern with calibrated orifice or venturi.
2. Ball: Brass or stainless steel.
3. Stem Seals: EPDM O-rings.
4. Disc: Glass- and carbon-filled PTFE.
5. Seat: PTFE.
6. End Connections: Flanged or grooved.
7. Pressure Gauge Connections: Integral seals for portable differential pressure meter.

8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg F.

C. Automatic Flow-Control Valves:

1. Body: Brass or ferrous metal.
2. Combination Assemblies: Include bronze or brass-alloy ball valve.
3. Identification Tag: Marked with zone identification, valve number, and flow rate.
4. Size and Capacity: For each application, provide a valve with rated capacity equal to or greater than capacity of device being served.
5. Performance: Maintain constant flow within plus or minus 10 percent, regardless of system pressure fluctuations.
6. Minimum CWP Rating: 175 psig .
7. Maximum Operating Temperature: 200 deg F .

## 2.2 AIR VENTS

A. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

## 2.3 STRAINERS

A. Y-Pattern Strainers:

1. Body: ASTM A126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.

3. Strainer Screen: Stainless steel, 20 -mesh strainer, or perforated stainless steel basket.
4. CWP Rating: 125 psig.

## 2.4 FLEXIBLE CONNECTORS

### A. Stainless Steel Bellows, Flexible Connectors:

1. Body: Stainless steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine all piping specialties for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Examine threads on all devices for form and cleanliness.
- C. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- D. Do not attempt to repair defective piping specialties; replace with new devices. Remove defective piping specialties from site.

### 3.2 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- B. Install manual vents at heat-transfer coils and elsewhere as required for air venting.

END OF SECTION

SECTION 233113  
METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round and flat-oval ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Requirements:

1. Section 230548 "Vibration Controls for HVAC" for seismic restraint devices and installation.
2. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
3. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 ADDITIONAL REQUIREMENTS FOR THIS PROJECT

- A. Unless otherwise noted, all metal ductwork shall be G90 galvanized steel.
- B. Do not support ducts from bar joist bridging.

1.3 DEFINITIONS

- A. OSHPD: Office of Statewide Health Planning and Development (State of California).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Airstream Surfaces: Surfaces in contact with airstream comply with requirements in ASHRAE 62.1.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."
- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

- D. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

## 2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
  - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
  - 2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
- B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
  - 2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All longitudinal seams are to be Pittsburgh lock seams unless otherwise specified for specific application.
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.3 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
  - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.

2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
- B. Source Limitations: Obtain single-wall round and flat oval ducts and fittings from single manufacturer.
  - C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
  - D. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- E. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - F. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.4 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials are to be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
  1. Galvanized Coating Designation: G90.
  2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Aluminum Sheets: Comply with ASTM B209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- D. Tie Rods: Galvanized steel, 1/4-inch- minimum diameter for lengths 36 inches or less; 3/8-inch- minimum diameter for lengths longer than 36 inches.

## 2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets are to be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
- B. Water-Based Joint and Seam Sealant:
  - 1. Application Method: Brush on.
  - 2. Solids Content: Minimum 65 percent.
  - 3. Shore A Hardness: Minimum 20.
  - 4. Water resistant.
  - 5. Mold and mildew resistant.
  - 6. VOC: Maximum 75 g/L (less water).
  - 7. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
  - 8. Service: Indoor or outdoor.
  - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- C. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- D. Round Duct Joint O-Ring Seals:
  - 1. Seal is to provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and is to be rated for 10-inch wg static-pressure class, positive or negative.
  - 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
  - 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

## 2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.
- E. Steel Cables for Stainless Steel Ducts: Stainless steel complying with ASTM A492.
- F. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
  - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  - 2. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

## PART 3 - EXECUTION

### 3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.
- B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts in maximum practical lengths with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

- J. Install fire , combination fire/smoke, and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.
- K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
- M. Elbows: Use long-radius elbows wherever they fit.
  - 1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
  - 2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.
- N. Branch Connections: Use lateral or conical branch connections.

### 3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

### 3.3 DUCTWORK EXPOSED TO WEATHER

- A. All external joints are to have secure watertight mechanical connections. Seal all openings to provide weatherproof construction.
- B. Construct ductwork to resist external loads of wind, snow, ice, and other effects of weather. Provide necessary supporting structures.
- C. Single Wall:
  - 1. Where ducts have external insulation, provide weatherproof aluminum jacket. See Section 230713 "Duct Insulation."

### 3.4 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### 3.6 DUCTWORK CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.7 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

### 3.8 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
  - 1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.
- B. Supply Ducts:
  - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units :
    - a. Pressure Class: Positive 1- inch wg.
    - b. Minimum SMACNA Seal Class: A .
    - c. SMACNA Leakage Class for Rectangular: 8 .
    - d. SMACNA Leakage Class for Round and Flat Oval: 8 .
  - 2. Ducts Connected to VAV Air-Handling Units :
    - a. Pressure Class: Positive 3- inch wg or greater.
    - b. Minimum SMACNA Seal Class: A .
    - c. SMACNA Leakage Class for Rectangular: 8 .
    - d. SMACNA Leakage Class for Round and Flat Oval: 8 .
    - e. All ductwork with a static pressure greater than 3 inches water gauge shall be tested in accordance with the SMACNA HVAC Air Duct Leakage Test Manual and be shown to have a rate of air leakage (CL) less than or equal to 4.0, where  $CL = F/P^{0.65}$   
F = The measured leakage rate in cfm per 100 square feet of duct surface  
P = The static pressure of the test.
- C. Return Ducts:
  - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units :
    - a. Pressure Class: Positive or negative 1- inch wg.
    - b. Minimum SMACNA Seal Class: A .
    - c. SMACNA Leakage Class for Rectangular: 8 .

- d. SMACNA Leakage Class for Round and Flat Oval: 8 .
- 2. Ducts Connected to Air-Handling Units :
  - a. Pressure Class: Positive or negative 4- inch wg.
  - b. Minimum SMACNA Seal Class: A .
  - c. SMACNA Leakage Class for Rectangular: 8 .
  - d. SMACNA Leakage Class for Round and Flat Oval: 8 .
- D. Exhaust Ducts:
  - 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
    - a. Pressure Class: Negative 1- inch wg.
    - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
    - c. SMACNA Leakage Class for Rectangular: 8 .
    - d. SMACNA Leakage Class for Round and Flat Oval: 8 .
  - 2. Ducts Connected to Air-Handling Units :
    - a. Pressure Class: Positive or negative 2- inch wg.
    - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
    - c. SMACNA Leakage Class for Rectangular: 8 .
    - d. SMACNA Leakage Class for Round and Flat Oval: 8 .
  - 3. Ducts Connected to Equipment Not Listed above:
    - a. Pressure Class: Positive or negative 2- inch wg.
    - b. Minimum SMACNA Seal Class: A if negative pressure; A if positive pressure.
    - c. SMACNA Leakage Class for Rectangular: 8 .
    - d. SMACNA Leakage Class for Round and Flat Oval: 8 .
- E. Intermediate Reinforcement:
  - 1. Galvanized-Steel Ducts: Galvanized steel .
- F. Elbow Configuration:

1. Rectangular Duct - Requirements for All Velocities: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
  - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
  - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
  - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
  - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
    - 1) Radius-to Diameter Ratio: 1.5.
  - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
  - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam .

G. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
  - a. Rectangular Main to Rectangular Branch: 45-degree entry.
  - b. Rectangular Main to Round Branch: Conical spin in.
2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

END OF SECTION

SECTION 233300  
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Fire dampers.
  - 2. Combination Fire and Smoke dampers.
  - 3. Flange connectors.
  - 4. Flexible connectors.
  - 5. Duct accessory hardware.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. For duct silencers, include pressure drop, dynamic insertion loss, and self-generated noise data. Include breakout noise calculations for high-transmission-loss casings.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with 2021 Virginia Mechanical Code.
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 FIRE DAMPERS

- A. Type: dynamic; rated and labeled in accordance with UL 555 by an NRTL.

- B. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000 fpm velocity.
- C. Fire Rating: 1-1/2 hours.
- D. Frame: Curtain type with blades inside airstream ; fabricated with roll-formed galvanized steel; with mitered and interlocking corners; gauge in accordance with UL listing.
- E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel; gauge in accordance with UL listing.
- F. Mounting Orientation: Vertical or horizontal as indicated.
- G. Blades: Roll-formed galvanized sheet steel. Material gauge is to be in accordance with UL listing.
- H. Horizontal Dampers: Include blade lock and stainless steel closure spring.
- I. Heat-Responsive Device:
  - 1. Replaceable, 165 deg F rated, fusible links.
  - 2. Resettable link and switch package, factory installed, 165 deg F rated.

## 2.3 COMBINATION FIRE/SMOKE DAMPERS

- A. Dampers shall meet requirements for combination fire smoke dampers in accordance with:
  - 1. 2021 Virginia Construction Code
  - 2. NFPA 80, 90A, 92, and 105
  - 3. CSFM Fire Damper Listing
  - 4. CSFM Leakage (Smoke) Damper Listing
- B. Dampers shall be tested, rated, and labeled in accordance with:
  - 1. UL 555 and UL 555S
- C. Dampers shall bear the AMCA Certified Ratings Seal for Air Performance in accordance with AMCA 511.
- D. Dampers shall have a UL Fire Resistance rating of 1.5 hours.
- E. Fire Closure Temperature:
  - A. Each combination fire-smoke damper shall be equipped with a factory installed heat responsive device rated to close the damper when the temperature at the damper reaches 250°F.

F. Dampers shall have a UL555S leakage rating of Leakage Class II. (20 cfm/ft<sup>2</sup> at 4 in. wg)

G. Dampers shall have a UL 555S differential pressure rating of 4 in. wg.

H. Dampers shall have a UL 555S velocity rating of 2000 fpm.

I. Construction:

1. Damper frame shall be 16 ga. galvanized steel formed into a 5 in. x 1 in. structural hat channel. Dampers less than 17 in. high shall utilize low profile geometry and 20 ga. galvanized steel for the top and bottom frame members to maximize free area. Frame shall be 4-piece construction with 1 ½ in. (minimum) integral overlapping gusset reinforcements in each corner to assure square corners and provide maximum resistance to racking.
2. Damper blades shall be 16 ga. galvanized steel strengthened by three longitudinal 1 in. deep V-grooves running the entire length of each blade. Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through the damper. Provide symmetrical blades of varying size as required to completely fill the damper opening.
3. The blade seals shall be extruded silicone rubber mechanically secured to the appropriate blade edges. The jamb shall be flexible stainless steel compression type.
4. Blade linkages shall be non-adjustable and concealed within the jamb of the damper.
5. Sleeves: Damper shall be supplied as a single assembly with a factory installed sleeve made of material matching that of the damper.
6. Fire closure device shall be a reusable, resettable link with an open/closed indicator. Electric heat-responsive device standard on any combination fire-smoke damper that performs the same function as a fusible link. Link can be reset, eliminating the need to replace a fusible link. The open and closed indicator shall be linked to the damper blade to indicate whether the damper blade is open or closed and shall have remote indicator lights.
7. Axle bearings shall be stainless steel sleeve type rotating in polished extruded holes in the damper frame.
8. Actuators shall be electric, 120V AC, two position type. Externally mounted (outside of duct).
9. Smoke detector shall be photoelectric type for air velocities of 100-4000 fpm and shall be factory mounted.

## 2.4 FLANGE CONNECTORS

- A. Description: Add-on or factory fabricated, slide-on transverse flange connectors, gaskets, and components.
- B. Material: Galvanized steel.
- C. Gauge and Shape: Match connecting ductwork.

## 2.5 FLEXIBLE CONNECTORS

- A. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Materials: Flame-retardant or noncombustible fabrics.
- D. Coatings and Adhesives: Comply with UL 181, Class 1.
- E. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- F. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
  - 1. Minimum Weight: 26 oz./sq. yd. .
  - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
  - 3. Service Temperature: Minus 40 to plus 200 deg F.
- G. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
  - 1. Minimum Weight: 24 oz./sq. yd. .
  - 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
  - 3. Service Temperature: Minus 50 to plus 250 deg F.

## 2.6 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## 2.7 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
  - 1. Galvanized Coating Designation: G60 .
  - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless Steel Sheets: Comply with ASTM A480/A480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.
- C. Aluminum Sheets: Comply with ASTM B209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, one-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B221, Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## PART 3 - EXECUTION

### 3.4 INSTALLATION

- A. Install duct accessories in accordance with their listings and installation instructions.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts.
- C. Set dampers to fully open position before testing, adjusting, and balancing.
- D. Install test holes at fan inlets and outlets and elsewhere as indicated and as needed for testing and balancing.
- E. Install access doors with swing against duct static pressure.
- F. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- G. Install flexible connectors to connect ducts to equipment.
- H. Install duct test holes where required for testing and balancing purposes.

END OF SECTION

SECTION 233416  
CENTRIFUGAL HVAC FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Square in-line centrifugal fans.

1.3 GENERAL REQUIREMENTS FOR THIS PROJECT

- A. Refer to Information on Drawings, particularly the Fan Schedules.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.
  - 2. Rated capacities, operating characteristics, and furnished specialties and accessories.
  - 3. Certified fan performance curves with system operating conditions indicated.
  - 4. Certified fan sound-power ratings.
  - 5. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 6. Material thickness and finishes, including color charts.
  - 7. Dampers, including housings, linkages, and operators.
  - 8. Fan speed controllers.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For centrifugal fans to include in normal operation, emergency operation, and maintenance manuals with replacement parts listing.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

### 2.2 ROOF EXHAUST FANS

- A. Description: roof mounted exhaust fans, shall be equal to Greenheck of model indicated.
  - 1. Housing Material: aluminum
  - 2. Backwards curved aluminum or steel blades
  - 3. Provide insect screen
- B. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- C. Fan Wheels: Backwards curved aluminum or steel blades
- D. Accessories:
  - 1. Manufacturer's manually adjustable fan speed controller.
  - 2. Provide with roof curb.
  - 3. Provide with motor operated control damper to close when fan is off.

### 2.3 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Install centrifugal fans level and plumb.
- B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

D. Equipment Mounting:

1. Support duct-mounted and other hanging centrifugal fans directly from the building structure, using suitable hanging systems as specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

E. Install units with clearances for service and maintenance.

F. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

### 3.2 DUCTWORK AND PIPING CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to fans to allow service and maintenance.

### 3.3 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

### 3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

### 3.5 ADJUSTING

A. Adjust damper linkages for proper damper operation.

- B. Adjust belt tension.
- C. Lubricate bearings.
- D. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

### 3.6 CLEANING

- A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean fans internally to remove foreign material and construction dirt and dust

END OF SECTION

SECTION 233600  
AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Modulating, single-duct air terminal units.
2. Casing liner.

1.2 REQUIREMENTS FOR THIS PROJECT

- A. Refer to Drawings for Additional Information, particularly the Equipment Schedules and Sequence of Operations.
- B. Coordinate use of two-way and three-way valves.
- C. Coordinate controls installation.
- D. Controls shall be provided by Controls Contractor and shall be factory installed prior to equipment shipping.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of air terminal unit.
  1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for air terminal units.
  2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals.
  1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Instructions for resetting minimum and maximum air volumes.
    - b. Instructions for adjusting software set points.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a Qualified Electrical Testing Laboratory, and marked for intended location and application.
- B. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, "Section 6 - Heating, Ventilating, and Air Conditioning."

### 2.2 MODULATING, SINGLE-DUCT AIR TERMINAL UNITS

- A. Description: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.
- B. Casing: Minimum 22-gauge- thick galvanized steel.
  - 1. Casing Liner: Comply with requirements in "Casing Liner" Article below for "Casing Liner, Fibrous Glass" Paragraph with "Antimicrobial Erosion-Resistant Coating" Subparagraph with "Perforated Metal Liner" Subparagraph .
  - 2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
  - 3. Air Outlet: S-slip and drive connections , size matching inlet size.
  - 4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
- C. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
  - 1. Maximum Damper Leakage: 2 percent of nominal airflow at 3-inch wg inlet static pressure.
- D. Airflow Sensor:
  - 1. The airflow sensor shall be a differential pressure airflow device measuring total and static pressures, and mounted to the inlet valve.
  - 2. Plastic parts shall be fire-resistant, complying with UL 94.
  - 3. The airflow sensor shall be RoHS (Restriction of Hazardous Substances) compliant. Material containing polybrominated compounds shall not be acceptable.
  - 4. Control tubing shall be protected by grommets at the wall of the airflow sensor's housing.

5. The airflow sensor shall be furnished with twelve total pressure sensing ports and four static pressure sensing ports, and shall include a center averaging chamber that amplifies the sensed airflow signal.
6. After balancing, the airflow sensor signal accuracy shall be plus or minus five percent throughout terminal operating range.
7. The airflow sensor shall maintain accuracy plus or minus five percent throughout terminal operating range even without 3 equivalent straight duct diameters per ASHRAE 130

E. Hot Heating Coils:

1. The hot water coil casing shall be constructed from a minimum 20 gauge, 0.032 inch galvanized steel, factory-installed on the terminal discharge with slip-and-drive attachment for downstream ductwork.
2. The water coil fins shall be 0.0045 inch aluminum fins, mechanically-bonded to seamless 0.50 by 0.016 inch copper tubes.
3. Fins shall be sine wave configuration.
4. Standard coil shall be a 10 fins-per-inch fin construction.
5. High capacity coil shall be a 12 fins-per-inch fin construction.
6. All water coils shall be hydrostatically tested to a minimum 390 pounds per square inch, with a minimum burst pressure of 1800 pounds per square inch at ambient temperature. All water coils are rated for a maximum of 300 pounds per square inch working pressure at 200 degrees Fahrenheit.

F. Electronic Controls:

1. Electronic Damper Actuator: 24 V, fail in last position.
2. Electronic Thermostat: Wall-mounted electronic type with temperature set-point display in Fahrenheit and Celsius.
3. Electronic Air Volume Controller: Pressure-independent analog electronic controller, factory calibrated and field adjustable to minimum and maximum air volumes; provides consistent airflow to the space in response to electronic thermostat signal while compensating for inlet static-pressure variations of up to 4 inches wg; includes a multipoint velocity sensor at air inlet.

G. Direct Digital Controls:

1. Terminal Unit Controller to be provided by and installed by the controls contractor.
2. Control Sequence: See Drawings for control sequences.

## 2.3 CASING LINER

- A. Casing Liner, Fibrous Glass: Foil faced Fibrous-glass duct liner, complying with ASTM C1071, NFPA 90A or NFPA 90B, and with NAIMA AH124.
  - 1. Minimum Thickness: 1 inch.
    - a. Maximum Thermal Conductivity:
      - 1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
      - 2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
  - 2. Foil-Faced Liner: Minimum 0.001-inch reinforced, nonporous aluminum foil applied to matted insulation airstream face. Encapsulate all insulation edges with sheet metal angles and channels, or tape.
  - 3. Perforated Metal Liner: Perforated galvanized sheet metal encapsulating matted insulation face from airstream.
  - 4. Solvent -Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C916.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Comply with Section 230529 "Hangers and Supports for HVAC Piping and Equipment" and Section 233113 "Metal Ducts" for hangers and supports.
- B. Install air terminal units according to NFPA 90A.
- C. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.
- D. Install wall-mounted thermostats.

### 3.2 DUCTWORK CONNECTIONS

- A. Comply with requirements in Section 233113 "Metal Ducts" for connecting ducts to air terminal units.
- B. Make connections to air terminal units with flexible connectors complying with requirements in Section 233300 "Air Duct Accessories."

### 3.3 ELECTRICAL CONNECTIONS

- A. Install field power to each air terminal unit electrical power connection. Coordinate with air terminal unit manufacturer and installers.

- B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
- E. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
  - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
  - 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

### 3.4 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

### 3.5 IDENTIFICATION

- A. Label each air terminal unit with drawing designation, nominal airflow, maximum and minimum factory-set airflows , and coil type. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

### 3.6 STARTUP SERVICE

- A. Perform startup service.
  - 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
  - 2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
  - 3. Verify that controls and control enclosure are accessible.
  - 4. Verify that control connections are complete.
  - 5. Verify that nameplate and identification tag are visible.
  - 6. Verify that controls respond to inputs as specified.

### 3.7 ADJUSTING

- A. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air terminal unit testing, adjusting, and balancing.

END OF SECTION

SECTION 233713.13  
AIR DIFFUSERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Rectangular and square ceiling diffusers.

- B. Related Requirements:

- 1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
  - 2. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.

1.3 SPECIAL REQUIREMENTS FOR THIS PROJECT

- A. Refer to Drawings for Additional Information, particularly the Air Device Schedules.
- B. In general, air devices shall be steel with painted surface. Surface shall be white unless otherwise noted.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - 2. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 ROUND CEILING DIFFUSERS

- A. Devices shall be specifically designed for variable-air-volume flows.
- B. Material: Steel .
- C. Finish: Baked enamel, white .

- D. Face Style: Four cone.
- E. Mounting: Duct connection.
- F. Pattern: Fully adjustable .
- G. Dampers: Combination damper and grid.
- H. Accessories:
  - 1. Equalizing grid.

## 2.2 RECTANGULAR AND SQUARE CEILING DIFFUSERS

- A. Refer to Schedule on Drawings.
- B. Acceptable Manufacturers
  - 1. Metal-Aire.
  - 2. Nailor.
  - 3. Price.
  - 4. Titus.
- C. Devices shall be specifically designed for variable-air-volume flows.
- D. Material: Steel .
- E. Material in High Humidity locations: Aluminum.
- F. Finish: Baked enamel, white .
- G. Face Style: Three cone .
- H. Pattern: Adjustable.
- I. Dampers: Combination damper and grid.
- J. Accessories:
  - 1. Equalizing grid.
  - 2. Blanket insulation on top of diffusers in lay-in ceilings.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install diffusers level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

### 3.3 ADJUSTING

- A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 233713.23  
REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Fixed face registers and grilles.

- B. Related Requirements:

- 1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
  - 2. Section 233713.13 "Air Diffusers" for various types of air diffusers.

1.3 SPECIAL REQUIREMENTS FOR THIS PROJECT

- A. Refer to Drawings for Additional Information, particularly the Air Device Schedules.
- B. Air In general, air devices shall be steel with painted surface. Surface shall be white unless otherwise noted.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - 2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 GRILLES

- A. Fixed Face Grille :

- 1. Acceptable Manufacturers include but are not limited to:
    - a. Metal-Aire.

- b. Nailor.
  - c. Price.
  - d. Titus.
- 2. Material: Steel .
- 3. Material for Humid Conditions: Aluminum.
- 4. Finish: Baked enamel, white .
- 5. Face Blade Arrangement: Horizontal ; spaced 3/4 inch apart.
- 6. Core Construction: Removable.
- 7. Frame: 1-1/4 inches wide.
- 8. Mounting: .

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Install registers and grilles level and plumb.
- B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

#### 3.3 ADJUSTING

- A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 260519  
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper building wire.
2. Connectors and splices.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Copper building wire.
2. Connectors and splices.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Standards:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- D. Conductor Insulation:
1. Type THHN and Type THWN-2. Comply with UL 83.

2.2 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

## 2.3 FIRE ALARM WIRE AND CABLE

- A. Fire Alarm Power Branch Circuits: Building wire in conduit. Comply with NEC article 760.
- B. Initiating Device and Indicating Appliance Circuits: Power limited fire-protective signaling cable, copper conductor, 300 volts insulation rated 105 degrees C.
- C. Plenum Cable: Power limited fire-protective signaling cable classified for fire and smoke characteristics, copper conductor, 300 volts insulation rated 105 degrees C, suitable for use in air handling ducts, hollow spaces used as ducts, and plenums.
- D. Fire alarm circuit conductors have insulation color or code as follows:
  - 1. Power Branch Circuit Conductors: Black, red, white.
  - 2. Initiating Device Circuit: Black, red.
  - 3. Detector Power Supply: Violet, brown.
  - 4. Signal Device Circuit: Blue (positive), white (negative).
  - 5. Door Release: Gray, gray.
- E. Conductor insulation and multiconductor cable applications and wiring methods. (power-limited fire alarm (plfa) cables)
- F. Fpl (fire alarm cable): a general-use, power-limited fire alarm cable for non-riser, non-plenum applications.
- G. Fplr (fire alarm riser cable): designed for vertical runs in shafts or through multiple floors. A listed for plenum use cable that is used in air-handling spaces, such as above ceilings and below floors, due to its fire and smoke resistant properties.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders:
  - 1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
  - 2. Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors must be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits:
  - 1. Copper:
    - a. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
    - b. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- C. ASD Output Circuits Cable: Extra-flexible stranded for all sizes.

### 3.2 INSTALLATION, GENERAL

- A. Complete raceway installation between conductor and cable termination points in accordance with Section 26 05 33.13 "Conduits for Electrical Systems" prior to pulling conductors and cables.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

### 3.3 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inch of slack.

### 3.4 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

### 3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

### 3.6 FIRESTOPPING

- A. Provide firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of *assembly*.
- B. Comply with firestopping spec section 078113 Penetration Firestopping.

END OF SECTION

SECTION 260529  
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Steel slotted support systems.
- 2. Conduit and cable support devices.
- 3. Structural steel for fabricated supports and restraints.
- 4. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
- 5. Fabricated metal equipment support assemblies.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
  - a. Slotted support systems, hardware, and accessories.
  - b. Clamps.
  - c. Hangers.
  - d. Fasteners.
  - e. Anchors.
- 2. Include rated capacities and furnished specialties and accessories.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M.
  - 2. AWS D1.2/D1.2M.

## PART 2 - PRODUCTS

### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.
  - 1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  - 2. Material for Channel, Fittings, and Accessories: Galvanized steel
  - 3. Channel Width: 1-5/8
  - 4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
- B. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.
- D. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Mechanical-Expansion Anchors: Insert-wedge-type, steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  - 2. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
  - 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
  - 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.
  - 5. Toggle Bolts: steel springhead type.
  - 6. Hanger Rods: Threaded steel.

### 2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
  2. NECA 101
  3. NECA 105.
- B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
1. Secure raceways and cables to these supports
  2. Retain paragraph below for projects where seismic design requirements do not apply. Consider retaining for light-commercial projects only.
- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, raceways may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
  2. To New Concrete: Bolt to concrete inserts.
  3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  4. To Existing Concrete: Expansion anchor fasteners.

5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts or Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
  6. To Light Steel: Sheet metal screws.
  7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete.
- C. Anchor equipment to concrete base as follows:
  1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  2. Install anchor bolts to elevations required for proper attachment to supported equipment.
  3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION

SECTION 260533.13  
CONDUITS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type ERM-C-S duct raceways, elbows, couplings, and nipples.
2. Type FMC-S and Type FMC-A duct raceways.
3. Type LFMC duct raceways.
4. Type PVC duct raceways and fittings.
5. Fittings for conduit, tubing, and cable.
6. Electrically conductive corrosion-resistant compounds for threaded conduit.
7. Solvent cements.

1.2 DEFINITIONS

- A. Conduit: A structure containing one or more duct raceways.
- B. Duct Raceway: A single enclosed raceway for conductors or cable.
- C. Duct Bank: An arrangement of conduit providing one or more continuous duct raceways between two points.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Type ERM-C-S duct raceways, elbows, couplings, and nipples.
2. Type FMC-duct raceways.
3. Type PVC duct raceways and fittings.
4. Fittings for conduit, tubing, and cable.
5. Electrically conductive corrosion-resistant compounds for threaded conduit.
6. Solvent cements.

B. Sustainable design submittals.

1. Solvent cements.

PART 2 - PRODUCTS

2.1 TYPE EMT-S DUCT RACEWAYS AND ELBOWS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN FJMX; including UL 797.

B. Raceway Color Codes:

Red- Fire Alarm

Orange- Telcom

Blue- 208/120V Power

Purple- Security

## 2.2 TYPE LFMC DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DXHR; including UL 360.

## 2.3 TYPE PVC DUCT RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DZYR; including UL 651.

## 2.4 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
- 2.

## 2.5 SOLVENT CEMENTS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
  2. Listing Criteria: UL CCN DWTT; including UL 514B.
- B. Source Quality Control:
1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
  2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.
- C. UL DWTT - Solvent Cements for Type PVC Duct Raceways and Fittings:

### PART 3 - EXECUTION

#### 3.1 SELECTION OF CONDUITS FOR ELECTRICAL SYSTEMS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of duct raceways. Consult Architect for resolution of conflicting requirements.

#### 3.2 INSTALLATION OF CONDUITS FOR ELECTRICAL SYSTEMS

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:
1. Type ERM-C-S: Article 344 of NFPA 70 and NECA NEIS 101.
  2. Type FMC-S: Article 348 of NFPA 70 and NECA NEIS 101.
  3. Type LFMC: Article 350 of NFPA 70 and NECA NEIS 101.
  4. Type PVC: Article 356 of NFPA 70 and NECA NEIS 111.
  5. Expansion Fittings: NEMA FB 2.40.
  6. Consult Architect for resolution of conflicting requirements.
- C. Interfaces with Other Work:
1. Coordinate installation of new products for with existing conditions.

END OF SECTION

SECTION 260553  
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Labels.
2. Bands and tubes.
3. Tapes and stencils.
4. Tags.
5. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Signs, labels, and tags required for personnel safety must comply with the following standards:

1. Safety Colors: NEMA Z535.1.
2. Facility Safety Signs: NEMA Z535.2.
3. Safety Symbols: NEMA Z535.3.
4. Product Safety Signs and Labels: NEMA Z535.4.
5. Safety Tags and Barricade Tapes for Temporary Hazards: NEMA Z535.5.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Color-Coding for Phase- and Voltage-Level Identification, 1000 V or Less: Use colors listed below for ungrounded conductors.

1. Colors for 208Y/120 V Circuits:
  - a. Phase A: Black.
  - b. Phase B: Red.
  - c. Phase C: Blue.

2. Colors for 480Y/277 V Circuits:
  - a. Phase A: Brown.
  - b. Phase B: Orange.
  - c. Phase C: Yellow.
3. Color for Neutral: White or gray
4. Color for Equipment Grounds: Green
5. Colors for Isolated Grounds: Green with two or more yellow stripes.

B. Warning Label Colors:

1. Identify system voltage with black letters on orange background.

C. Equipment Identification Labels:

1. Black letters on white field.

## 2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
- B. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.
- C. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3 mil thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

### 3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at location with high visibility and accessibility.
  2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to location and substrate.
- C. Snap-Around Labels: Secure tight to surface at location with high visibility and accessibility.
- D. Self-Adhesive Wraparound Labels: Secure tight to surface at location with high visibility and accessibility.
- E. Self-Adhesive Labels:
1. Install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
  2. Unless otherwise indicated, provide single line of text with 1/2 inch high letters on 1-1/2 inch high label; where two lines of text are required, use labels 2 inch high.
- F. Snap-Around Color-Coding Bands: Secure tight to surface at location with high visibility and accessibility.
- G. Write-on Tags:
1. Place in location with high visibility and accessibility.
- H. Baked-Enamel Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
  2. Unless otherwise indicated, provide single line of text with 1/2 inch high letters on minimum 1-1/2 inch high sign; where two lines of text are required, use signs minimum 2 inch high.
- I. Metal-Backed Butyrate Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
  2. Unless otherwise indicated, provide single line of text with 1/2 inch high letters on 1-1/2 inch high sign; where two lines of text are required, use labels 2 inch high.
- J. Laminated Acrylic or Melamine Plastic Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
  2. Unless otherwise indicated, provide single line of text with 1/2 inch high letters on 1-1/2 inch high sign; where two lines of text are required, use labels 2 inch high.
- K. Cable Ties: General purpose, for attaching tags, except as listed below:
1. Outdoors: UV-stabilized nylon.
  2. In Spaces Handling Environmental Air: listed for Plenum use. .

### 3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes
- D. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes self-adhesive labels with conductor designation.
- E. Equipment Identification Labels:
  - 1. Indoor Equipment: Self-adhesive label or Baked-enamel signs

END OF SECTION

SECTION 260923  
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Indoor occupancy and vacancy sensors.
2. Switchbox-mounted occupancy sensors.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Indoor occupancy and vacancy sensors.
2. Switchbox-mounted occupancy sensors.
3. Daylight Harvesting Sensors

1.3 WARRANTY

1. Standard manufacturers warranty

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY SENSORS

A. General Requirements for Sensors:

1. Ceiling or Wall mounted, solid-state indoor occupancy sensors.
2. Dual technology.
3. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
4. Operation:
  - a. Occupancy Sensor: Unless otherwise indicated, turn lights on at 50% when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.
5. Mounting:
  - a. Sensor: Suitable for mounting in any position in a standard device box or outlet box.
  - b. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
6. Bypass Switch: Override the "on" function in case of sensor failure.

- B. Dual-Technology Type: Ceiling or Wall mounted; detect occupants in coverage area using PIR and ultrasonic detection methods with Daylight Harvesting. The technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION OF SENSORS

- A. Coordinate layout and installation of ed devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's instructions.

### 3.3 FUNCTIONAL TESTING OF LIGHTING CONTROLS

- A. Perform the following procedures and operational verifications:
  - 1. Certify that the occupant sensor has been located and aimed in accordance with the manufacturer recommendations.
  - 2. Test each occupancy sensor.
  - 3. Where occupant sensor controls include status indicators, verify correct operation.
  - 4. The controlled lights turn off or down to the permitted levels within required time.
  - 5. For auto=on occupant sensor controls, the lights turn on the permitted level when an occupant enters space.
  - 6. The lights are not incorrectly turned on by movement in adjacent areas or by HVAC operation.

### 3.4 IDENTIFICATION

- A. Identify components and power and control wiring in accordance with Section 260553 "Identification for Electrical Systems.

1. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

### 3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
  1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to 20 minutes or less.

END OF SECTION

SECTION 262726  
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General-use switches.
2. General-grade duplex straight-blade receptacles.
3. Receptacles with ground-fault protective devices.

1.2 ACTION SUBMITTALS

A. Product Data:

1. General-use switches.
2. General-grade duplex straight-blade receptacles.
3. Receptacles with ground-fault protective devices.
4. Split Duplex Switched Receptacle

PART 2 - PRODUCTS

2.1 GENERAL-USE SWITCHES, DIMMER SWITCHES, AND FAN-SPEED CONTROLLER SWITCHES

A. Toggle Switch:

1. Regulatory Requirements:
  - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Options:
  - a. Device Color: As indicated on architectural Drawings.
3. Accessories:
  - a. Cover Plate high-impact thermoplastic (nylon) with smooth finish and color: matching wiring device; from same manufacturer as wiring device.
  - b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

2.2 GENERAL-GRADE SINGLE STRAIGHT-BLADE RECEPTACLES

A. Single Straight-Blade Receptacle

1. Regulatory Requirements:

- a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
- 2. General Characteristics:
  - a. NEMA 5-20R.
  - b. Plug Load Control - Link to motion sensors to automatically turn off outlets when office is unoccupied  
Central Command support. For BACnet Management System control  
Interoperable. Communicates wirelessly with other devices using the EnOcean wireless standard

## PART 1 - EXECUTION

### 1.1 INSTALLATION OF SWITCHES

- A. Comply with manufacturer's instructions.

### 1.2 INSTALLATION OF STRAIGHT-BLADE RECEPTACLES

- A. Comply with manufacturer's instructions.
- B. Identification:
  - 1. Identify cover or cover plate for device with panelboard identification and circuit number

END OF SECTION

SECTION 265119  
LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Arrange in order of luminaire designation.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaires.
  - 4. Include emergency lighting units, including batteries and chargers.
  - 5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
- B. Product Schedule: For luminaires and lamps.
- C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

## 1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

# PART 2 - PRODUCTS

## 2.1 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.2 LUMINAIRE SUPPORT

- A. Comply with manufacturer's instructions.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Supports:
  - 1. Sized and rated for luminaire weight.

2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal. Perform all such tests in the presence of the SFMO.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.

END OF SECTION

SECTION 270528  
PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Metal conduits and fittings.
  - 2. Nonmetallic conduits and fittings.
  - 3. Metal wireways and auxiliary gutters.
  - 4. Hooks.
  - 5. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

- A. GRC: Galvanized rigid conduit.
- B. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product data for the following:
  - 1. Wireways and fittings.
  - 2. Boxes, enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.
- B. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
  2. Comply with TIA-569-D.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. EMT: Comply with ANSI C80.3 and UL 797.
- E. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Fittings for EMT:
    - a. Material: Steel.
    - b. Type: Set screw or compression.
  2. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
- F. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## 2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal trough of rectangular cross section fabricated to required size and shape, without holes or knockouts, and with hinged or removable covers.
- B. General Requirements for Metal Wireways and Auxiliary Gutters:
1. Comply with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
  2. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application, minimum NEMA 3R.
  3. Comply with TIA-569-D.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type Screw-cover type Flanged-and-gasketed type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

## 2.3 HOOKS

- A. Description: Prefabricated sheet metal cable supports for telecommunications cable. Note: fire alarm is Mass Communication rated and all in conduit.

- B. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- C. Comply with TIA-569-D.
- D. stainless steel.
- E. J or U shape.

## 2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Description: Enclosures for communications.
- B. General Requirements for Boxes, Enclosures, and Cabinets:
  - 1. Comply with TIA-569-D.
  - 2. Boxes, enclosures, and cabinets installed in wet locations shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for use in wet locations.
  - 3. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
  - 4. Device Box Dimensions: 4 inches square by 2-1/8 inches deep. Boxes in furred out walls may be more shallow to accommodate finish. See drawings.
  - 5. Gangable boxes are prohibited.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- E. Metal Floor Boxes:
  - 1. Material: Cast metal.
  - 2. Type: Fully adjustable.
  - 3. Shape: Rectangular.
  - 4. Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- H. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, with continuous-hinge cover with flush latch unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- I. Cabinets:

1. NEMA 250, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

## PART 3 - EXECUTION

### 3.1 PATHWAY APPLICATION

A. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Pathway locations include the following:
  - a. Loading dock.
  - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
  - c. Mechanical rooms.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Damp or Wet Locations: GRC.
6. Pathways for Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical-fiber-cable pathway Plenum-type, communications-cable pathway, EMT.
7. Pathways for Concealed General-Purpose Distribution of Communications Cable: General-use, optical-fiber-cable pathway EMT.

B. Minimum Pathway Size: 3/4-inch trade size for copper and aluminum cables, and 1 inch for optical-fiber cables.

C. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use set-screw or compression, steel fittings. Comply with NEMA FB 2.10.

### 3.2 INSTALLATION

- A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:
  - 1. NECA 1.
  - 2. NECA/BICSI 568.
  - 3. TIA-569-D.
  - 4. NECA 101
  - 5. NECA 105.
- B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- C. Comply with requirements in Section 270529 "Hangers and Supports for Communications Systems" for hangers and supports.
- D. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- E. Complete pathway installation before starting conductor installation.
- F. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- G. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. Stub-ups to Above Recessed Ceilings:
  - 1. Use EMT, IMC, or RMC for pathways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- K. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- L. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus one additional quarter-turn.
- M. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure, to assure a continuous ground path.
- N. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

- O. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.
- P. Pathways for Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
1. 3/4-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet.
  2. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.
  3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- Q. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway-sealing fittings according to NFPA 70.
- R. Install devices to seal pathway interiors at accessible locations. Locate seals, so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  2. Where an underground service pathway enters a building or structure.
  3. Where otherwise required by NFPA 70.
- S. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.
- T. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT that is located where environmental temperature change may exceed 100 deg F, and that has straight-run length that exceeds 100 feet.
  2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
    - a. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    - b. Attics: 135 deg F temperature change.
  3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.

4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
  5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- U. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.
  - V. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
  - W. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.
  - X. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
  - Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
  - Z. Set metal floor boxes level and flush with finished floor surface.
  - AA. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- 3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS
- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."
- 3.4 FIRESTOPPING
- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."
- 3.5 PROTECTION
- A. Protect coatings, finishes, and cabinets from damage or deterioration.
    1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 270529  
HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Steel slotted support systems for communication raceways.
- 2. Conduit and cable support devices.
- 3. Structural steel for fabricated supports and restraints.
- 4. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
- 5. Fabricated metal equipment support assemblies.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
  - a. Slotted support systems, hardware, and accessories.
  - b. Clamps.
  - c. Hangers.
  - d. Sockets.
  - e. Eye nuts.
  - f. Fasteners.
  - g. Anchors.
  - h. Saddles.
  - i. Brackets.
- 2. Include rated capacities and furnished specialties and accessories.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M.

2. AWS D1.2/D1.2M.

## PART 2 - PRODUCTS

### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.
  1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  2. Material for Channel, Fittings, and Accessories: Galvanized steel.
  3. Channel Width: Selected for applicable load criteria.
  4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  5. Channel Dimensions: Selected for applicable load criteria.
- B. Conduit and Cable Support Devices: Steel clamps, hangers, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored communications conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  1. Powder-Actuated Fasteners: Threaded-steel stud for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  2. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
  4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
  5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.
  6. Toggle Bolts: All-steel springhead type.
  7. Hanger Rods: Threaded steel.

## 2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
  - 1. NECA 1.
  - 2. NECA/BICSI 568.
  - 3. TIA-569-D.
  - 4. NECA 101.
  - 5. NECA 105.
- B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for pathways specified in Section 270528 "Pathways for Communications Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with single-bolt conduit clamps.
- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

### 3.2 SUPPORT INSTALLATION

- A. Raceway Support Methods: In addition to methods described in NECA 1, EMT IMC and RMC may be supported by openings through structure members, according to NFPA 70.

- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten communications items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Use approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Use expansion anchor fasteners.
  - 5. Instead of expansion anchors, powder-actuated-driven threaded studs, provided with lock washers and nuts, may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
  - 6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
  - 7. To Light Steel: Sheet metal screws.
  - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor communications materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

END OF SECTION

SECTION 271513  
COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Category 6 twisted pair cable.
  - 2. Twisted pair cable hardware, including plugs and jacks.
  - 3. Multiuser telecommunications outlet assembly.
  - 4. Cable management system.
  - 5. Cabling identification products.
  - 6. Grounding provisions for twisted pair cable.
  - 7. Source quality control requirements for twisted pair cable.

1.3 DEFINITIONS

- A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- B. EMI: Electromagnetic interference.
- C. FTP: Shielded twisted pair.
- D. F/FTP: Overall foil screened cable with foil screened twisted pair.
- E. F/UTP: Overall foil screened cable with unscreened twisted pair.
- F. IDC: Insulation displacement connector.
- G. LAN: Local area network.
- H. Jack: Also commonly called an "outlet," it is the fixed, female connector.
- I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.
- J. RCDD: Registered Communications Distribution Designer.
- K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

- L. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
- M. S/FTP: Overall braid screened cable with foil screened twisted pair.
- N. S/UTP: Overall braid screened cable with unscreened twisted pairs.
- O. UTP: Unscreened (unshielded) twisted pair.

#### 1.4 COPPER HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.
  - 1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
  - 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
  - 3. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. A work area is approximately 100 sq. ft., and includes the components that extend from the equipment outlets to the station equipment.
- C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Twisted pair cable testing plan.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For RCDD, installation supervisor, and field inspector.
- B. Field quality-control reports.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For splices and connectors to include in maintenance manuals.

## 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
  - 1. Layout Responsibility: Preparation of Shop Drawings, cabling administration Drawings, and field testing program development by an RCDD.
  - 2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
  - 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
  - 1. Test each pair of twisted pair cable for open and short circuits.

## 1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

## 1.11 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.
- B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.
- C. Grounding: Comply with TIA-607-B.

## 2.2 GENERAL CABLE CHARACTERISTICS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:

1. Communications, listed for Plenum use: Type CMP complying with UL 1685 or Type CMP in listed plenum communications raceway.
- B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  1. Flame-Spread Index: 25 or less.
  2. Smoke-Developed Index: 50 or less.
- C. RoHS compliant.

## 2.3 CATEGORY 6 TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500MHz.
- B. Standard: Comply with TIA-568-C.2 for Category 6 cables.
- C. Conductors: 100-ohm, 23 AWG solid copper.
- D. Shielding/Screening: Unshielded twisted pairs (UTP).
- E. Cable Rating: Plenum.
- F. Jacket: Color as scheduled thermoplastic.

## 2.4 TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.
- B. General Requirements for Twisted Pair Cable Hardware:
  1. Comply with the performance requirements of Category 6.
  2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
  3. Cables shall be terminated with connecting hardware of same category or higher.
- C. Source Limitations: Obtain twisted pair cable hardware from same manufacturer as twisted pair cable, from single source.
- D. Connecting Blocks:
  1. 110-style IDC for Category 6.
  2. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.
- E. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

1. Number of Terminals per Field: One for each conductor in assigned cables.
  2. Number of Jacks per Field: One for each four-pair cable indicated.
- F. Patch Cords: Factory-made, four-pair cables in 36-inch lengths; terminated with an eight-position modular plug at each end.
1. Cat 6 Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
- G. Plugs and Plug Assemblies:
1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
  2. Standard: Comply with TIA-568-C.2.
- H. Jacks and Jack Assemblies:
1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
  2. Designed to snap-in to a patch panel or faceplate.
  3. Standard: Comply with TIA-568-C.2.
- I. Faceplate:
1. Two port, vertical single gang faceplates designed to mount to single gang wall boxes. Unless noted otherwise.
  2. Metal Faceplate: Stainless steel,
  3. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.
    - a. Flush mounting jacks
- J. Legend:
1. Machine printed, in the field, using adhesive-tape label.

## 2.5 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

## 2.6 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Comply with TIA-607-B.

## 2.7 SOURCE QUALITY CONTROL

- A. Factory test cables on reels according to TIA-568-C.1.
- B. Factory test twisted pair cables according to TIA-568-C.2.
- C. Cable will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, attics, and gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables, except in unfinished spaces.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
  - 2. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications Systems."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

### 3.2 INSTALLATION OF PATHWAYS

- A. Comply with Section 270528 "Pathways for Communications Systems."
- B. Comply with Section 270529 "Hangers and Supports for Communications Systems."

### 3.3 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

- A. Comply with NECA 1 and NECA/BICSI 568.
- B. Group connecting hardware for cables into separate logical fields.
- C. Separation from EMI Sources:
  - 1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper

- communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
  3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
  4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
  5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
  6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

### 3.4 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."

### 3.5 GROUNDING

- A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."
- B. Comply with TIA-607-B and NECA/BICSI-607.

### 3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
  1. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

- B. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- C. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- D. Cable and Wire Identification:
  - 1. Label each cable matching existing labeling.

### 3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
  - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  - 3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
    - a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.
- D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION

SECTION 284621.11  
ADDRESSABLE FIRE-ALARM SYSTEMS

1.1 DEFINITIONS

- A. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:
  - 1. Control Voltage: Listed and labeled for use in remote-control, signaling, and power-limited circuits supplied by a Class 2 or Class 3 power supply having rated output not greater than 150 V and 5 A, allowing use of alternate wiring methods complying with NFPA 70, Article 725.
  - 2. Low Voltage: Listed and labeled for use in circuits supplied by a Class 1 or other power supply having rated output not greater than 1000 V, requiring use of wiring methods complying with NFPA 70, Article 300, Part I.

1.2 ACTION SUBMITTALS

- A. Approved Permit Submittal: Submittals must be approved by authorities having jurisdiction (DEB) following submitting them to Architect for approval.
- B. Product Data: For each type of product, including furnished options and accessories.
  - 1. Include construction details, material descriptions, dimensions, profiles, and finishes.
  - 2. Include rated capacities, operating characteristics, and electrical characteristics.
  - 3. The location and type of fire alarm system alarm-initiating appliances and the type of fire alarm system alarm notification appliances and control and trouble signaling equipment, the location of major components are not to be altered by the Contractor, without prior written approval by the A/E and the Building Official. Changes to the design during the construction phase of the project shall be submitted to the Building Official for review and approval.
- C. Shop Drawings: For fire-alarm system.
  - 1. Comply with recommendations and requirements in "Documentation" section of "Fundamentals" chapter in NFPA 72.
  - 2. Include plans, elevations, sections, and details, including details of attachments to other Work.
  - 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
  - 4. Detail assembly and support requirements.
  - 5. Include voltage drop calculations for notification-appliance circuits.
  - 6. Include battery-size calculations.
  - 7. Include input/output matrix.

8. Include written statement from manufacturer that equipment and components have been tested as a system and comply with requirements in this Section and in NFPA 72.
  9. Include performance parameters and installation details for each detector.
    - a. Locate detectors in accordance with manufacturer's written instructions.
  10. Include alarm signaling-service layout, grounding schematic, and single-line connection diagram.
  11. Equipment listing: All communication equipment must be listed for the intended purpose (e.g., UL 864 listed for fire alarm control units).
  12. Communication equipment must have both a primary and a secondary (backup) power source. If powered by the fire alarm control unit (FACU), the battery calculations must account for the additional load.
  13. Addressability: If an addressable fire alarm system is used, alarm signals sent to the supervising station must include the addressable device or zone identification.
  14. Documentation: Documentation showing how the selected communication method meets all applicable sections of NFPA 72 must be provided for review by the AHJ.
  15. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.
  16. Shop drawings to be prepared by a certified engineering technician (NICET Level III or IV).
- D. Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data.
1. Drawings showing location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of device.
  2. Design Calculations: Calculate requirements for selecting spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
  3. Indicate audible appliances required to produce square wave signal per NFPA 72.

### 1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Statements: For Installer.
- B. Sample Warranty: Submittal must include line item pricing for replacement parts and labor.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following
    - a. Comply with "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
    - b. Provide "Fire-Alarm System Record of Completion Documents" in accordance with "Completion Documents" Article in "Documentation" section of "Fundamentals" chapter in NFPA 72.
    - c. Complete wiring diagrams showing connections between devices and equipment. Each conductor must be numbered at every junction point with indication of origination and termination points.
    - d. Riser diagram.
    - e. Device addresses.
    - f. Provide "Inspection and Testing Form" in accordance with "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
      - 1) Equipment tested.
      - 2) Frequency of testing of installed components.
      - 3) Frequency of inspection of installed components.
      - 4) Requirements and recommendations related to results of maintenance.
      - 5) Manufacturer's user training manuals.
    - g. Manufacturer's required maintenance related to system warranty requirements.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Personnel must be trained and certified by manufacturer for installation of units required for this Project.

#### 1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail because of defects in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 ADDRESSABLE FIRE-ALARM SYSTEM

#### A. Description:

1. Noncoded, **UL-certified** addressable system, with multiplexed signal transmission. Head-in panel existing to remain. Demo existing devices as directed and install new fire alarm pull stations, strobes/horns, smoke detectors and associated wiring/conduit.

#### B. Performance Criteria:

1. Regulatory Requirements:
  - a. Fire-Alarm Components, Devices, and Accessories: Listed and labeled by a NRTL in accordance with VCC SECTION 9071.3 AND NFPA 72 2019 sections 10.3.1 through 10.3.3 for use with selected fire-alarm system and marked for intended location and application.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
  1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Preinstallation Testing: Perform verification of functionality of installed components of existing system prior to starting work. Document equipment or components not functioning as designed.
- B. Protection of In-Place Conditions: Protect devices during construction unless devices are placed in service to protect facility during construction.

### 3.3 INSTALLATION OF EQUIPMENT

- A. Comply with NECA 305, NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
  - 1. Devices placed in service before other trades have completed cleanup must be replaced.
  - 2. Devices installed, but not yet placed, in service must be protected from construction dust, debris, dirt, moisture, and damage in accordance with manufacturer's written storage instructions.
- B. Manual Fire-Alarm Pull Boxes:
  - 1. Install manual fire-alarm box in normal path of egress within 60 inch of exit doorway.
  - 2. Mount manual fire-alarm box on background of contrasting color.
  - 3. Operable part of manual fire-alarm box must be between 42 and 48 inch above floor level. Devices must be mounted at same height unless otherwise indicated.
- C. Smoke-Detector Spacing:
  - 1. Comply with "Smoke-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
  - 2. Lighting Fixtures: Locate detectors not closer than 12 inch from lighting fixture and not directly above pendant mounted or indirect lighting.
- D. Install cover on each smoke detector that is not placed in service during construction. Cover must remain in place except during system testing. Remove cover prior to system turnover.
- E. Audible Alarm-Indicating Devices: Install not less than 6 inch below ceiling. Install bells and horns on flush-mounted back boxes with device-operating mechanism concealed behind grille. Install devices at same height unless otherwise indicated.
- F. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inch below ceiling. Install devices at same height unless otherwise indicated.
- G. Device Location-Indicating Lights: Locate in public space near device they monitor.

### 3.4 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

- C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

### 3.5 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."
- C. Install nameplate for each control connection, indicating field control panel designation and I/O control designation feeding connection.

### 3.6 PATHWAYS

- A. Pathways must be installed in EMT.
- B. Exposed EMT must be painted red enamel.

### 3.7 CONNECTIONS

- A. Make addressable connections with supervised interface device to the following devices and systems. Install interface device less than 36 inch from device controlled. Make addressable confirmation connection when such feedback is available at device or system being controlled.

### 3.8 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals.

### 3.9 GROUNDING

- A. Ground FACU and associated circuits in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Ground shielded cables at control panel location only. Insulate shield at device location.

### 3.10 FIELD QUALITY CONTROL

- A. Field tests must be witnessed by authorities having jurisdiction.
- B. Administrant for Tests and Inspections:
  - 1. Owner will engage qualified testing agency to administer and perform tests and inspections.

2. Engage qualified testing agency to administer and perform tests and inspections.
3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
4. Administer and perform tests and inspections with assistance of factory-authorized service representative

C. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.
  - a. Inspection must be based on completed record Drawings and system documentation that is required by "Completion Documents, Preparation" table in "Documentation" section of "Fundamentals" chapter in NFPA 72.
  - b. Comply with "Visual Inspection Frequencies" table in "Inspection" section of "Inspection, Testing and Maintenance" chapter in NFPA 72; retain "Initial/Reacceptance" column and list only installed components.
2. System Testing: Comply with "Test Methods" table in "Testing" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for public operating mode in accordance with manufacturer's written instructions. Perform test using portable sound-level meter complying with Type 2 requirements in ASA S1.4 Part 1/IEC 61672-1.
4. Test audible appliances for private operating mode in accordance with manufacturer's written instructions.
5. Test visible appliances for public operating mode in accordance with manufacturer's written instructions.
6. Factory-authorized service representative must prepare "Fire Alarm System Record of Completion" in "Documentation" section of "Fundamentals" chapter in NFPA 72 and "Inspection and Testing Form" in "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

### 3.11 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system. Provide video recording of training to Owner

### 3.12 MAINTENANCE

- A. Maintenance Service: Beginning at Substantial Completion, maintenance service must include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies must be manufacturer's authorized replacement parts and supplies.
1. Include visual inspections in accordance with "Visual Inspection Frequencies" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.
  2. Perform tests in "Test Methods" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.
  3. Perform tests per "Testing Frequencies" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.

END OF SECTION

# APPENDIX

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## VIRGINIA WESTERN COMMUNITY COLLEGE

### PROJECT# 652-29014

#### I. SUMMARY

##### A. EXECUTIVE SUMMARY

Professional Service Industries, Inc., (PSI) was retained by Virginia Western Community College to develop a management plan for all facilities owned by the college. An asbestos assessment survey was conducted for friable asbestos-containing building materials, between June 7, 1988 and June 14, 1988. An asbestos assessment survey was conducted for nonfriable asbestos-containing materials, between March 13, 1992 and April 3, 1992. The results of the two inspections were utilized to develop a plan of action on how to properly manage asbestos-containing materials within the various facilities.

The purpose of the inspections were to identify, quantify, sample and differentiate into priority levels, all accessible friable, nonfriable and potentially friable materials suspected of containing asbestos.

A Priority Level I classification represents a high potential for exposure to asbestos-containing materials. These areas should be isolated immediately and the asbestos-containing material should be removed using approved methods and qualified personnel. A Priority Level II classification represents the next highest potential for exposure. All debris should be removed and the material be repaired or removed using approved methods and qualified personnel. A Priority Level III classification represents a slight to moderate potential for exposure. All removal and repair work must be completed using approved methods and qualified personnel. Undamaged material should be maintained and monitored in accordance with the Operations and Maintenance (O & M) section of this plan. A Priority Level IV classification represents the lowest exposure level. Material under this classification should be maintained and monitored in accordance with the O & M section of this plan, or removed using approved methods and qualified personnel.

Fine Arts Building: A Priority Level I classification has been assigned to material within the crawl space area of the Fine Arts Building. This material consists of corrugated pipe covering and associated mudded joint packings that have fallen to the ground. This area has been scheduled for removal activities during the month of June, 1992.

A Priority Level II classification has been assigned to the corrugated pipe covering that remains in the basement area. This material is scheduled for removal during abatement activities for the crawl space.

Priority Level III and IV materials consisted of vinyl floor tile and the associated mastic.

Continuing Education Cottage: No asbestos-containing building materials were identified in this building.

Duncan Hall: A Priority Level I has been assigned to wrapped cardboard/paper pipe covering and the associated mudded joint packing in the janitor's closet pipe chases on the first and second floors. It appears that when repair work was done on the piping, asbestos-containing

insulation was removed and left on the floor surface. PSI recommends immediate isolation of these areas and gross removal using proper removal methods.

A Priority Level III has been assigned to magnesia and wrapped cardboard/paper pipe covering throughout the first floor. All pipe covering should be closely monitored for water and physical damage.

A Priority Level IV has been assigned to the remaining asbestos-containing vinyl floor tile and associated mastic.

Craig Hall: There are no Priority Level I or II materials in this building. A Priority Level III has been assigned to wrapped cardboard/paper pipe covering and magnesia pipe covering on the domestic water and the hot water supply/return (HWS/R) lines. The pipe covering above the ceiling in the women's rest room had been cut during repair work. No debris was found and the cut section does not appear to have a high potential for exposure. PSI recommends that this material be closely monitored for any physical damage or water damage.

The remaining asbestos-containing materials, vinyl floor tile and associated mastic, have been assigned a Priority Level IV classification.

Chapman Hall: There are no Priority Level I or II materials in this building. A Priority Level III classification has been assigned to wrapped cardboard/paper pipe covering, magnesia pipe covering and the mudded joint packing on the domestic water and HWS/R piping.

A Priority Level IV classification has been assigned to the vinyl floor tile and associated mastic.

Anderson Hall: There are no Priority Level I, II or III materials in this building. A Priority Level IV classification was assigned to vinyl floor tile, associated mastic and mastic used to seal ductwork.

Fishburn Hall: There are no Priority Level I materials in this building. A Priority Level II classification has been assigned to ceiling tile on the first and second floor. This material is in good condition, but has a moderate potential for disturbance.

A Priority Level IV classification has been assigned to vinyl floor tile, associated mastic and mastic used to seal ductwork.

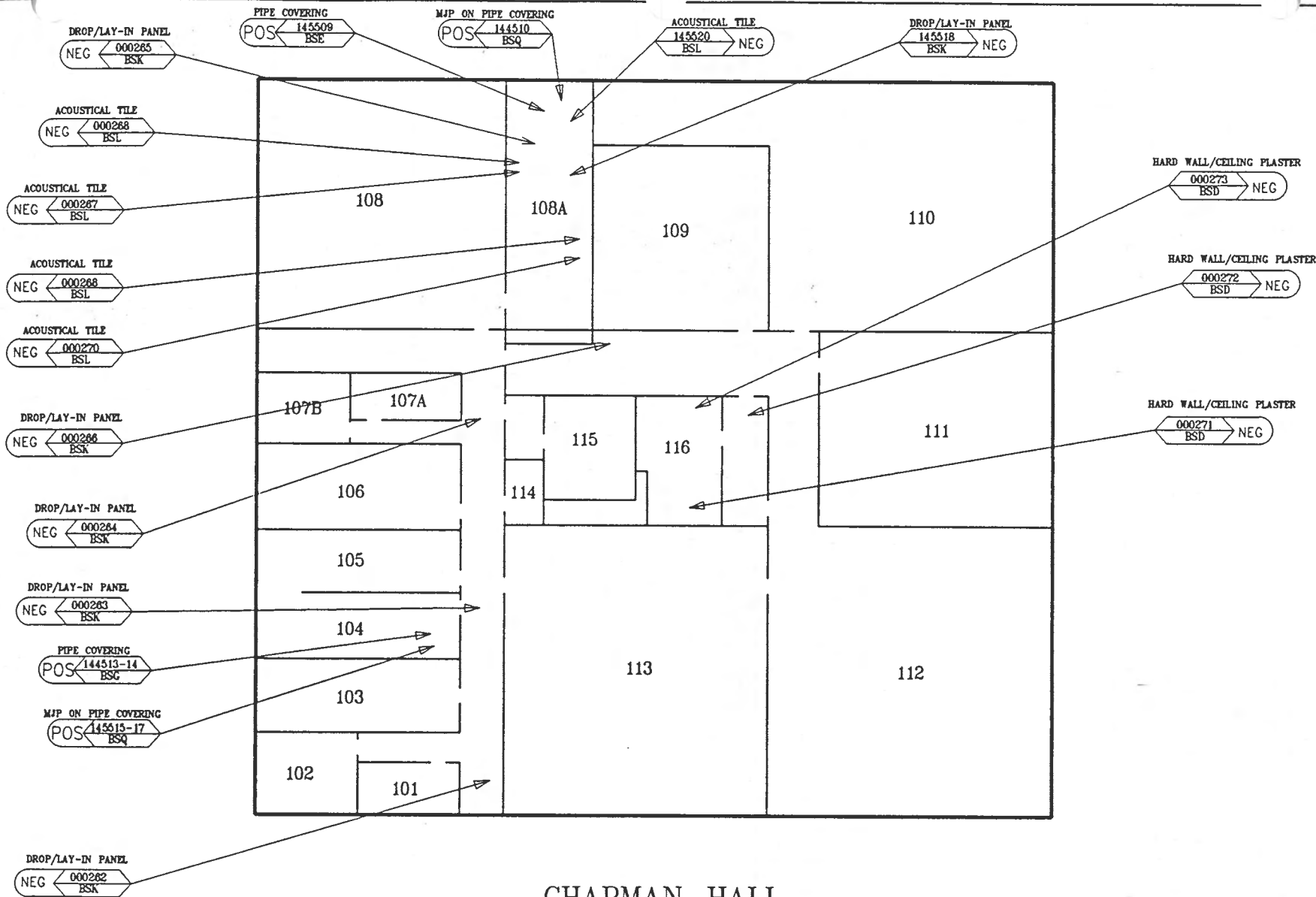
Brown Library: A Priority Level I classification has been assigned to fireproofing material on the southeast ceiling of the boiler room. No debris was found on the floor; however, this material is highly friable and exposed to moderate vibrations and air currents. PSI has previously recommended isolation of the area and gross removal of the material. This recommendation is still appropriate.

A Priority Level II classification has been assigned to pipe covering in the boiler room. This material has a high level of physical damage and should be removed.

A Priority Level III classification has been assigned to mudded joint packings on domestic water piping.

A Priority Level IV classification has been assigned to vinyl floor tile and associated mastic.

Trailer J: There was no asbestos-containing material found in this structure.



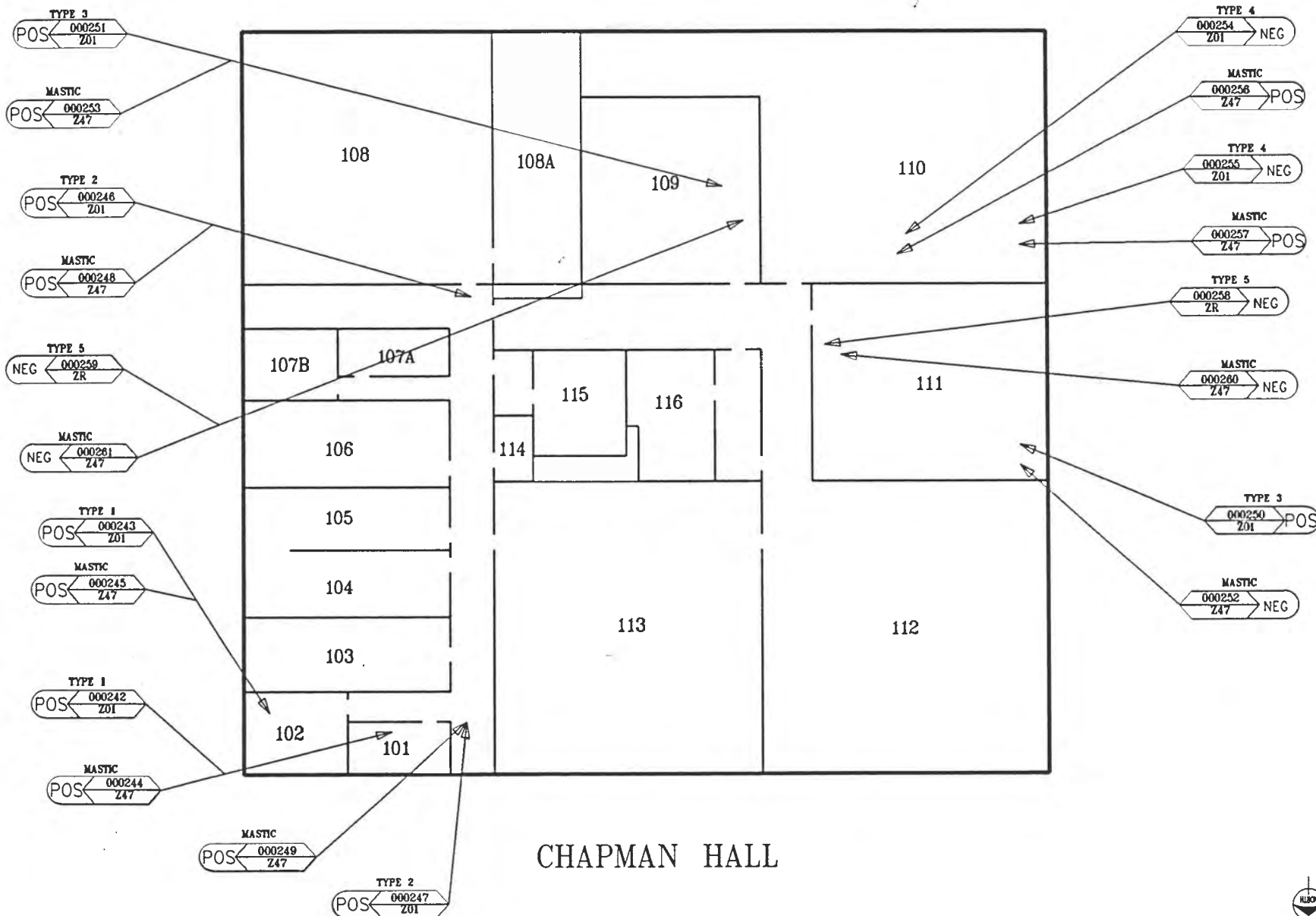
NOT TO SCALE



BULK SAMPLE CODE	124376 BSA	SAMPLE IDENTIFICATION NUMBER
------------------------	---------------	------------------------------------

PSI	PROFESSIONAL SERVICE INDUSTRIES, INC. ENVIRONMENTAL SERVICES 4121 COX ROAD, SUITE 107 GLEN ALLEN, VIRGINIA 23060
VWCC-12	

ASBESTOS ASSESSMENT SURVEY
VA WESTERN COMMUNITY COLLEGE ROANOKE, VIRGINIA



# CHAPMAN HALL

NOT TO SCALE



TYPE	DESCRIPTION	TYPE	DESCRIPTION
1	TAN/BROWN & WHITE SPECKED FLOOR TILE		
2	CREAM/BROWN & BLACK SPECKED FLOOR TILE		
3	OFF-WHITE THIN STREAKED FLOOR TILE		
4	DARK CREAM/BROWN SPECKED FLOOR TILE		
5	2" BLACK KICKSTRIP		

BULK SAMPLE CODE	124376 BSA	SAMPLE IDENTIFICATION NUMBER
------------------------	---------------	------------------------------------

PSI	PROFESSIONAL SERVICE INDUSTRIES, INC. ENVIRONMENTAL SERVICES 4121 COX ROAD, SUITE 107 GLEN ALLEN, VIRGINIA 23060
VWCC-13	

ASBESTOS ASSESSMENT SURVEY
VA WESTERN COMMUNITY COLLEGE ROANOKE, VIRGINIA

**\*\* INSPECTION / MANAGEMENT PLAN \*\***

Virginia Western Community College

652-29014

Inspected By: Thomas B. Burke

Certification: VCU St: VA

State Cert #: 01338 St: VA

Gross Square Ft: 9,894

Building Name: Chapman Hall

Building Number: 286-001-00005

Inspection Dates: 06/14/88 and 03/16/92

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 01 \*\*\***

SYSTEM: HWS/R

LOCATION: Ground Floor - Room 108A

TYPE OF MATERIAL: Pipe Covering

DAMAGE CATEGORY:

Damaged or Significantly Damaged

Thermal System Insulating ACM

REASON for DAMAGE CATEGORY:

Old Age Deterioration

POTENTIAL FOR DISTURBANCE:

Slight

SAMPLE#

195509

%ASB

65

MATERIAL QUANTITIES

120 linear ft. - 6 in. O.D.

REMOVAL COST

\$1,440.00

REPLACEMENT COSTS

\$840.00

TOTAL COSTS

\$2,280.00

**-----MANAGEMENT PLAN RECOMMENDATION-----**

RECOMMENDED RESPONSE ACTION:

O & M Maintain/Monitor

PRIORITY:

III

PREVENTIVE MEASURES:

See O&M Section: OMA

LEA RESPONSE:

ACTION ELECTION:

RESPONSE ACTION SCHEDULE

START DATE

04/30/92

COMPLETION DATE

Ongoing

LEA COMMENTS:

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 02 \*\*\***

SYSTEM: HWS/R

LOCATION: Ground Floor - Room 108A

TYPE OF MATERIAL: MJP on Pipe Covering

DAMAGE CATEGORY:

Damaged or Significantly Damaged

Thermal System Insulating ACM

REASON for DAMAGE CATEGORY:

Old Age Deterioration

POTENTIAL FOR DISTURBANCE:

Slight

SAMPLE#

195510

%ASB

10

195511

15

195512

10

MATERIAL QUANTITIES

4 - 6 in. joint

REMOVAL COST

\$164.00

REPLACEMENT COSTS

\$76.00

TOTAL COSTS

\$240.00

**-----MANAGEMENT PLAN RECOMMENDATION-----**

RECOMMENDED RESPONSE ACTION:

O & M Maintain/Monitor

PRIORITY:

III

PREVENTIVE MEASURES:

See O&M Section: OMA

LEA RESPONSE:

ACTION ELECTION:

RESPONSE ACTION SCHEDULE

START DATE

04/30/92

COMPLETION DATE

Ongoing

LEA COMMENTS:

**\*\* INSPECTION / MANAGEMENT PLAN \*\***

Virginia Western Community College

652-29014

Inspected By: Thomas B. Burke

Certification: VCU St: VA

State Cert #: 01338 St: VA

Gross Square Ft: 9,894

Building Name: Chapman Hall

Building Number: 286-001-00005

Inspection Dates: 06/14/88 and 03/16/92

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 03 \*\*\***

SYSTEM: Domestic Water

LOCATION: Ground Floor - Rooms 104,  
110,112 & 113

TYPE OF MATERIAL: Wrapped Cardboard/Paper Pipe Covering

DAMAGE CATEGORY:

Damaged or Significantly Damaged

Thermal System Insulating ACM

REASON for DAMAGE CATEGORY:

Old Age Deterioration

POTENTIAL FOR DISTURBANCE:

Slight

SAMPLE#

195513

%ASB

05

195514

05

MATERIAL QUANTITIES

625 linear ft. - 4 in. O.D.

REMOVAL COST

\$6,250.00

REPLACEMENT COSTS

\$3,750.00

TOTAL COSTS

\$10,000.00

-----MANAGEMENT PLAN RECOMMENDATION-----

RECOMMENDED RESPONSE ACTION:

O & M Maintain/Monitor

PRIORITY:

III

PREVENTIVE MEASURES:

See O&M Section: OMA

LEA RESPONSE:

ACTION ELECTION:

RESPONSE ACTION SCHEDULE

START DATE

04/30/92

COMPLETION DATE

Ongoing

LEA COMMENTS:

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 04 \*\*\***

SYSTEM: Domestic Water

LOCATION: Ground Floor - Rooms 104,  
110,112 & 113

TYPE OF MATERIAL: MJP on Wrapped Cardboard/Paper Pipe  
Covering

DAMAGE CATEGORY:

Damaged or Significantly Damaged

Thermal System Insulating ACM

REASON for DAMAGE CATEGORY:

Old Age Deterioration

POTENTIAL FOR DISTURBANCE:

Slight

SAMPLE#

195515

%ASB

10

195516

15

195517

15

MATERIAL QUANTITIES

47 - 4 in. joint

REMOVAL COST

\$1,551.00

REPLACEMENT COSTS

\$705.00

TOTAL COSTS

\$2,256.00

-----MANAGEMENT PLAN RECOMMENDATION-----

RECOMMENDED RESPONSE ACTION:

O & M Maintain/Monitor

PRIORITY:

III

PREVENTIVE MEASURES:

See O&M Section: OMA

LEA RESPONSE:

ACTION ELECTION:

RESPONSE ACTION SCHEDULE

START DATE

04/30/92

COMPLETION DATE

Ongoing

LEA COMMENTS:

**\*\* INSPECTION / MANAGEMENT PLAN \*\***

Virginia Western Community College

652-29014

Building Name: Chapman Hall  
Building Number: 286-001-00005  
Inspection Dates: 06/14/88 and 03/16/92

Inspected By: Thomas B. Burke  
Certification: VCU St: VA  
State Cert #: 01338 St: VA  
Gross Square Ft: 9,894

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 05 \*\*\***

SYSTEM: HWS/R	LOCATION: Ground Floor - Above Drop Ceiling	TYPE OF MATERIAL: Pipe Covering		
DAMAGE CATEGORY: Damaged or Significantly Damaged Thermal System Insulating ACM	REASON for DAMAGE CATEGORY: Old Age Deterioration	POTENTIAL FOR DISTURBANCE: Slight	SAMPLE# 195509	%ASB 65
MATERIAL QUANTITIES 175 linear ft. - 6 in. O.D.	REMOVAL COST \$2,100.00	REPLACEMENT COSTS \$1,225.00	TOTAL COSTS \$3,325.00	

-----MANAGEMENT PLAN RECOMMENDATION-----

RECOMMENDED RESPONSE ACTION: O & M Maintain/Monitor	PRIORITY: III	PREVENTIVE MEASURES: See O&M Section: OMA
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LEA RESPONSE:  
ACTION ELECTION:

RESPONSE ACTION SCHEDULE

START DATE 04/30/92	COMPLETION DATE Ongoing
------------------------	----------------------------

LEA COMMENTS:

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 06 \*\*\***

SYSTEM: HWS/R	LOCATION: Ground Floor - Above Drop Ceiling	TYPE OF MATERIAL: MJP on Pipe Covering		
DAMAGE CATEGORY: Damaged or Significantly Damaged Thermal System Insulating ACM	REASON for DAMAGE CATEGORY: Old Age Deterioration	POTENTIAL FOR DISTURBANCE: Slight	SAMPLE# 195510 195511 195512	%ASB 10 15 10
MATERIAL QUANTITIES 8 - 6 in. joint	REMOVAL COST \$328.00	REPLACEMENT COSTS \$152.00	TOTAL COSTS \$480.00	

-----MANAGEMENT PLAN RECOMMENDATION-----

RECOMMENDED RESPONSE ACTION: O & M Maintain/Monitor	PRIORITY: III	PREVENTIVE MEASURES: See O&M Section: OMA
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LEA RESPONSE:  
ACTION ELECTION:

RESPONSE ACTION SCHEDULE

START DATE 04/30/92	COMPLETION DATE Ongoing
------------------------	----------------------------

LEA COMMENTS:

**\*\* INSPECTION / MANAGEMENT PLAN \*\***

Virginia Western Community College

652-29014

Inspected By: Thomas B. Burke

Certification: VCU St: VA

State Cert #: 01338 St: VA

Gross Square Ft: 9,894

Building Name: Chapman Hall

Building Number: 286-001-00005

Inspection Dates: 06/14/88 and 03/16/92

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 07 \*\*\***

SYSTEM: Domestic Water

LOCATION: Ground Floor - Above  
Drop Ceiling

TYPE OF MATERIAL: Wrapped Cardboard/Paper Pipe Covering

DAMAGE CATEGORY:

Damaged or Significantly Damaged

Thermal System Insulating ACM

REASON for DAMAGE CATEGORY:

Old Age Deterioration

POTENTIAL FOR DISTURBANCE:

Slight

SAMPLE#

195513

%ASB

05

195514

05

MATERIAL QUANTITIES

215 linear ft. - 4 in. O.D.

REMOVAL COST

\$2,150.00

REPLACEMENT COSTS

\$1,290.00

TOTAL COSTS

\$3,440.00

**-----MANAGEMENT PLAN RECOMMENDATION-----**

RECOMMENDED RESPONSE ACTION:

O & M Maintain/Monitor

PRIORITY:

III

PREVENTIVE MEASURES:

See O&M Section: OMA

LEA RESPONSE:

ACTION ELECTION:

RESPONSE ACTION SCHEDULE

START DATE

04/30/92

COMPLETION DATE

Ongoing

LEA COMMENTS:

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 08 \*\*\***

SYSTEM: Domestic Water

LOCATION: Ground Floor - Above  
Drop Ceiling

TYPE OF MATERIAL: MJP on Wrapped Cardboard/Paper Pipe  
Covering

DAMAGE CATEGORY:

Damaged or Significantly Damaged

Thermal System Insulating ACM

REASON for DAMAGE CATEGORY:

Old Age Deterioration

POTENTIAL FOR DISTURBANCE:

Slight

SAMPLE#

195515

%ASB

10

195516

15

195517

15

MATERIAL QUANTITIES

19 - 4 in. joint

REMOVAL COST

\$627.00

REPLACEMENT COSTS

\$285.00

TOTAL COSTS

\$912.00

**-----MANAGEMENT PLAN RECOMMENDATION-----**

RECOMMENDED RESPONSE ACTION:

O & M Maintain/Monitor

PRIORITY:

III

PREVENTIVE MEASURES:

See O&M Section: OMA

LEA RESPONSE:

ACTION ELECTION:

RESPONSE ACTION SCHEDULE

START DATE

04/30/92

COMPLETION DATE

Ongoing

LEA COMMENTS:

**\*\* INSPECTION / MANAGEMENT PLAN \*\***

Virginia Western Community College

652-29014

Inspected By: Thomas B. Burke

Certification: VCU St: VA

State Cert #: 01338 St: VA

Gross Square Ft: 9,894

Building Name: Chapman Hall

Building Number: 286-001-00005

Inspection Dates: 03/16/92

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 09 \*\*\***

SYSTEM: Floor Material

LOCATION: Rooms 101 - 107B

TYPE OF MATERIAL: 9x9 Vinyl Floor Tile -  
Tan with Brown/White Specks

DAMAGE CATEGORY:

ACBM with Potential for Damage

REASON for DAMAGE CATEGORY:

Good Condition

POTENTIAL FOR DISTURBANCE:

Slight

SAMPLE#

242

%ASB

02

243

02

MATERIAL QUANTITIES

1,500 sq. ft.

REMOVAL COST

\$6,000.00

REPLACEMENT COSTS

\$4,950.00

TOTAL COSTS

\$10,950.00

**-----MANAGEMENT PLAN RECOMMENDATION-----**

RECOMMENDED RESPONSE ACTION:

O & M Maintain/Monitor

PRIORITY:

IV

PREVENTIVE MEASURES:

See O&M Section: OMI

LEA RESPONSE:

ACTION ELECTION:

RESPONSE ACTION SCHEDULE

START DATE

04/30/92

COMPLETION DATE

Ongoing

LEA COMMENTS:

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 10 \*\*\***

SYSTEM: Floor Material

LOCATION: Rooms 101 - 107B

TYPE OF MATERIAL: Mastic - Black

DAMAGE CATEGORY:

ACBM with Potential for Damage

REASON for DAMAGE CATEGORY:

Good Condition

POTENTIAL FOR DISTURBANCE:

Slight

SAMPLE#

244

%ASB

02

245

02

MATERIAL QUANTITIES

1,500 sq. ft.

REMOVAL COST

Cost Included in VAT's Removal/Replacement Cost

REPLACEMENT COSTS

TOTAL COSTS

**-----MANAGEMENT PLAN RECOMMENDATION-----**

RECOMMENDED RESPONSE ACTION:

O & M Maintain/Monitor

PRIORITY:

IV

PREVENTIVE MEASURES:

See O&M Section: OMZ

LEA RESPONSE:

ACTION ELECTION:

RESPONSE ACTION SCHEDULE

START DATE

04/30/92

COMPLETION DATE

Ongoing

LEA COMMENTS:

**\*\* INSPECTION / MANAGEMENT PLAN \*\***

Virginia Western Community College

652-29014

Building Name: Chapman Hall  
Building Number: 286-001-00005  
Inspection Dates: 03/16/92

Inspected By: Thomas B. Burke  
Certification: VCU St: VA  
State Cert #: 01338 St: VA  
Gross Square Ft: 9,894

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 11 \*\*\***

SYSTEM: Floor Material	LOCATION: Ground Floor - Main Corridor	TYPE OF MATERIAL: 9x9 Vinyl Floor Tile - Cream with Brown/Black Specks		
DAMAGE CATEGORY: ACBM with Potential for Damage	REASON for DAMAGE CATEGORY: Good Condition	POTENTIAL FOR DISTURBANCE: Slight	SAMPLE# 246 247	%ASB 03 03

MATERIAL QUANTITIES	REMOVAL COST	REPLACEMENT COSTS	TOTAL COSTS
600 sq. ft.	\$2,400.00	\$1,980.00	\$4,380.00

-----MANAGEMENT PLAN RECOMMENDATION-----

RECOMMENDED RESPONSE ACTION: O & M Maintain/Monitor	PRIORITY: IV	PREVENTIVE MEASURES: See O&M Section: OMI
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LEA RESPONSE: ACTION ELECTION:	RESPONSE ACTION SCHEDULE
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START DATE 04/30/92	COMPLETION DATE Ongoing
------------------------	----------------------------

LEA COMMENTS:

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 12 \*\*\***

SYSTEM: Floor Material	LOCATION: Ground Floor - Main Corridor	TYPE OF MATERIAL: Mastic - Black		
DAMAGE CATEGORY: ACBM with Potential for Damage	REASON for DAMAGE CATEGORY: Good Condition	POTENTIAL FOR DISTURBANCE: Slight	SAMPLE# 248 249	%ASB 02 02

MATERIAL QUANTITIES	REMOVAL COST	REPLACEMENT COSTS	TOTAL COSTS
600 sq. ft.	Cost Included in VAT's Removal/Replacement Cost		

-----MANAGEMENT PLAN RECOMMENDATION-----

RECOMMENDED RESPONSE ACTION: O & M Maintain/Monitor	PRIORITY: IV	PREVENTIVE MEASURES: See O&M Section: OMZ
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LEA RESPONSE: ACTION ELECTION:	RESPONSE ACTION SCHEDULE
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START DATE 04/30/92	COMPLETION DATE Ongoing
------------------------	----------------------------

LEA COMMENTS:

**\*\* INSPECTION / MANAGEMENT PLAN \*\***

Virginia Western Community College

652-29014

Inspected By: Thomas B. Burke

Certification: VCU St: VA

State Cert #: 01338 St: VA

Gross Square Ft: 9,894

Building Name: Chapman Hall

Building Number: 286-001-00005

Inspection Dates: 03/16/92

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 13 \*\*\***

SYSTEM: Floor Material

LOCATION: Ground Floor - West Corridor,  
and Rooms 109 - 111

TYPE OF MATERIAL: 1x1 Vinyl Floor Tile -  
Off-White with Thin Streaks

DAMAGE CATEGORY:

ACBM with Potential for Damage

REASON for DAMAGE CATEGORY:

Good Condition

POTENTIAL FOR DISTURBANCE:

Slight

SAMPLE#

250

%ASB

03

251

03

MATERIAL QUANTITIES

4,000 sq. ft.

REMOVAL COST

\$16,000.00

REPLACEMENT COSTS

\$13,200.00

TOTAL COSTS

\$29,200.00

**-----MANAGEMENT PLAN RECOMMENDATION-----**

RECOMMENDED RESPONSE ACTION:

O & M Maintain/Monitor

PRIORITY:

IV

PREVENTIVE MEASURES:

See O&M Section: OMI

LEA RESPONSE:

ACTION ELECTION:

RESPONSE ACTION SCHEDULE

START DATE

04/30/92

COMPLETION DATE

Ongoing

LEA COMMENTS:

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 14 \*\*\***

SYSTEM: Floor Material

LOCATION: Ground Floor - West Corridor,  
and Rooms 109 - 111

TYPE OF MATERIAL: Mastic - Black

DAMAGE CATEGORY:

ACBM with Potential for Damage

REASON for DAMAGE CATEGORY:

Good Condition

POTENTIAL FOR DISTURBANCE:

Slight

SAMPLE#

252

%ASB

00

253

02

MATERIAL QUANTITIES

4,000 sq. ft.

REMOVAL COST

Cost Included in VAT's Removal/Replacement Cost

REPLACEMENT COSTS

TOTAL COSTS

**-----MANAGEMENT PLAN RECOMMENDATION-----**

RECOMMENDED RESPONSE ACTION:

O & M Maintain/Monitor

PRIORITY:

IV

PREVENTIVE MEASURES:

See O&M Section: OMZ

LEA RESPONSE:

ACTION ELECTION:

RESPONSE ACTION SCHEDULE

START DATE

04/30/92

COMPLETION DATE

Ongoing

LEA COMMENTS:

**\*\* INSPECTION / MANAGEMENT PLAN \*\***

Virginia Western Community College

652-29014

Inspected By: Thomas B. Burke

Certification: VCU St: VA

State Cert #: 01338 St: VA

Gross Square Ft: 9,894

Building Name: Chapman Hall

Building Number: 286-001-00005

Inspection Dates: 03/16/92

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 15 \*\*\***

SYSTEM: Floor Material

LOCATION: Room 110

TYPE OF MATERIAL: 1x1 Vinyl Floor Tile -  
Dark Cream with Brown Specks

DAMAGE CATEGORY:

N/A

REASON for DAMAGE CATEGORY:

N/A

POTENTIAL FOR DISTURBANCE:

N/A

SAMPLE#

254

%ASB

00

255

00

MATERIAL QUANTITIES

350 sq. ft.

REMOVAL COST

\$0.00

REPLACEMENT COSTS

\$0.00

TOTAL COSTS

\$0.00

-----MANAGEMENT PLAN RECOMMENDATION-----

RECOMMENDED RESPONSE ACTION:

N/A

PRIORITY:

N/A

PREVENTIVE MEASURES:

See O&M Section: N/A

LEA RESPONSE:

ACTION ELECTION: N/A

RESPONSE ACTION SCHEDULE

START DATE

N/A

COMPLETION DATE

N/A

LEA COMMENTS:

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 16 \*\*\***

SYSTEM: Floor Material

LOCATION: Room 110

TYPE OF MATERIAL: Mastic - Black

DAMAGE CATEGORY:

ACBM with Potential for Damage

REASON for DAMAGE CATEGORY:

Good Condition

POTENTIAL FOR DISTURBANCE:

Slight

SAMPLE#

256

%ASB

02

257

02

MATERIAL QUANTITIES

350 sq. ft.

REMOVAL COST

\$1,400.00

REPLACEMENT COSTS

\$1,155.00

TOTAL COSTS

\$2,555.00

-----MANAGEMENT PLAN RECOMMENDATION-----

RECOMMENDED RESPONSE ACTION:

O & M Maintain/Monitor

PRIORITY:

IV

PREVENTIVE MEASURES:

See O&M Section: OMZ

LEA RESPONSE:

ACTION ELECTION:

RESPONSE ACTION SCHEDULE

START DATE

04/30/92

COMPLETION DATE

Ongoing

LEA COMMENTS:

**\*\* INSPECTION / MANAGEMENT PLAN \*\***

Virginia Western Community College

652-29014

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Certification: VCU St: VA

State Cert #: 01338 St: VA

Gross Square Ft: 9,894

Building Name: Chapman Hall

Building Number: 286-001-00005

Inspection Dates: 03/16/92

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 17 \*\*\***

SYSTEM: Floor Material	LOCATION: Ground Floor - Throughout	TYPE OF MATERIAL: 2" Kickstrip - Black		
DAMAGE CATEGORY:	REASON for DAMAGE CATEGORY:	POTENTIAL FOR DISTURBANCE:	SAMPLE#	%ASB
N/A	N/A	N/A	258	00
			259	00

MATERIAL QUANTITIES	REMOVAL COST	REPLACEMENT COSTS	TOTAL COSTS
75 sq. ft.	\$0.00	\$0.00	\$0.00

**-----MANAGEMENT PLAN RECOMMENDATION-----**

RECOMMENDED RESPONSE ACTION:	PRIORITY:	PREVENTIVE MEASURES:
N/A	N/A	See O&M Section: N/A

LEA RESPONSE:

ACTION ELECTION: N/A

**RESPONSE ACTION SCHEDULE**

START DATE	COMPLETION DATE
N/A	N/A

LEA COMMENTS:

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 18 \*\*\***

SYSTEM: Floor Material	LOCATION: Ground Floor - Throughout	TYPE OF MATERIAL: Mastic - Brown		
DAMAGE CATEGORY:	REASON for DAMAGE CATEGORY:	POTENTIAL FOR DISTURBANCE:	SAMPLE#	%ASB
N/A	N/A	N/A	260	00
			261	00

MATERIAL QUANTITIES	REMOVAL COST	REPLACEMENT COSTS	TOTAL COSTS
75 sq. ft.	\$0.00	\$0.00	\$0.00

**-----MANAGEMENT PLAN RECOMMENDATION-----**

RECOMMENDED RESPONSE ACTION:	PRIORITY:	PREVENTIVE MEASURES:
N/A	N/A	See O&M Section: N/A

LEA RESPONSE:

ACTION ELECTION: N/A

**RESPONSE ACTION SCHEDULE**

START DATE	COMPLETION DATE
N/A	N/A

LEA COMMENTS:

**\*\* INSPECTION / MANAGEMENT PLAN \*\***

Virginia Western Community College

652-29014

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Certification: VCU St: VA

State Cert #: 01338 St: VA

Gross Square Ft: 9,894

Building Name: Chapman Hall

Building Number: 286-001-00005

Inspection Dates: 06/14/88 and 03/16/92

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 19 \*\*\***

SYSTEM: Ceiling Material

LOCATION: Ground Floor - Main Corridor

TYPE OF MATERIAL: 2x2 Lay-In Ceiling Panel -  
White with Pits

DAMAGE CATEGORY:

N/A

REASON for DAMAGE CATEGORY:

N/A

POTENTIAL FOR DISTURBANCE:

N/A

SAMPLE#

262

%ASB

00

263

00

264

00

MATERIAL QUANTITIES

600 sq. ft.

REMOVAL COST

\$0.00

REPLACEMENT COSTS

\$0.00

TOTAL COSTS

\$0.00

-----MANAGEMENT PLAN RECOMMENDATION-----

RECOMMENDED RESPONSE ACTION:

N/A

PRIORITY:

N/A

PREVENTIVE MEASURES:

See O&M Section: N/A

LEA RESPONSE:

ACTION ELECTION: N/A

RESPONSE ACTION SCHEDULE

START DATE

N/A

COMPLETION DATE

N/A

LEA COMMENTS:

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 20 \*\*\***

SYSTEM: Ceiling Material

LOCATION: Ground Floor - West Corridor,  
Room 108 (Office Area) and Rooms 109,110 & 111

TYPE OF MATERIAL: 2x4 Lay-In Ceiling Panel -  
White with Pits

DAMAGE CATEGORY:

N/A

REASON for DAMAGE CATEGORY:

N/A

POTENTIAL FOR DISTURBANCE:

N/A

SAMPLE#

195518

%ASB

00

265

00

266

00

MATERIAL QUANTITIES

3,900 sq. ft.

REMOVAL COST

\$0.00

REPLACEMENT COSTS

\$0.00

TOTAL COSTS

\$0.00

-----MANAGEMENT PLAN RECOMMENDATION-----

RECOMMENDED RESPONSE ACTION:

N/A

PRIORITY:

N/A

PREVENTIVE MEASURES:

See O&M Section: N/A

LEA RESPONSE:

ACTION ELECTION: N/A

RESPONSE ACTION SCHEDULE

START DATE

N/A

COMPLETION DATE

N/A

LEA COMMENTS:

**\*\* INSPECTION / MANAGEMENT PLAN \*\***

Virginia Western Community College

652-29014

Building Name: Chapman Hall  
Building Number: 286-001-00005  
Inspection Dates: 06/14/88 and 03/16/92

Inspected By: Thomas B. Burke  
Certification: VCU St: VA  
State Cert #: 01338 St: VA  
Gross Square Ft: 9,894

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 21 \*\*\***

SYSTEM: Miscellaneous	LOCATION: Ground Floor - Room 108A - Ceiling and Walls	TYPE OF MATERIAL: 1x1 Acoustical Tile - White/Brown		
DAMAGE CATEGORY: N/A	REASON for DAMAGE CATEGORY: N/A	POTENTIAL FOR DISTURBANCE: N/A	SAMPLE# 195520 267 268	%ASB 00 00 00

MATERIAL QUANTITIES	REMOVAL COST	REPLACEMENT COSTS	TOTAL COSTS
600 sq. ft.	\$0.00	\$0.00	\$0.00

-----MANAGEMENT PLAN RECOMMENDATION-----

RECOMMENDED RESPONSE ACTION: N/A	PRIORITY: N/A	PREVENTIVE MEASURES: See O&M Section: N/A
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LEA RESPONSE:  
ACTION ELECTION: N/A

RESPONSE ACTION SCHEDULE

START DATE N/A	COMPLETION DATE N/A
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LEA COMMENTS:

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 22 \*\*\***

SYSTEM: Miscellaneous	LOCATION: Ground Floor - Rooms 101 - 107B - Ceiling and Walls	TYPE OF MATERIAL: 1x1 Acoustical Tile - White with Dark Pits		
DAMAGE CATEGORY: N/A	REASON for DAMAGE CATEGORY: N/A	POTENTIAL FOR DISTURBANCE: N/A	SAMPLE# 195519 269 270	%ASB 00 00 00

MATERIAL QUANTITIES	REMOVAL COST	REPLACEMENT COSTS	TOTAL COSTS
2,000 sq. ft.	\$0.00	\$0.00	\$0.00

-----MANAGEMENT PLAN RECOMMENDATION-----

RECOMMENDED RESPONSE ACTION: N/A	PRIORITY: N/A	PREVENTIVE MEASURES: See O&M Section: N/A
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LEA RESPONSE:  
ACTION ELECTION: N/A

RESPONSE ACTION SCHEDULE

START DATE N/A	COMPLETION DATE N/A
-------------------	------------------------

LEA COMMENTS:

**\*\* INSPECTION / MANAGEMENT PLAN \*\***

Virginia Western Community College

652-29014

Inspected By: Thomas B. Burke

Certification: VCU St: VA

State Cert #: 01338 St: VA

Gross Square Ft: 9,894

Building Name: Chapman Hall

Building Number: 286-001-00005

Inspection Dates: 03/16/92

**\*\*\* INSPECTION RESULTS HOMOGENEOUS SAMPLING AREA NUMBER - 23 \*\*\***

SYSTEM: Cementitious

LOCATION: Ground Floor - Men's Room -  
Walls and Ceiling

TYPE OF MATERIAL: Hard Wall/Ceiling Plaster

DAMAGE CATEGORY:

N/A

REASON for DAMAGE CATEGORY:

N/A

POTENTIAL FOR DISTURBANCE:

N/A

SAMPLE#

271

272

273

%ASB

00

00

00

MATERIAL QUANTITIES

150 sq. ft.

REMOVAL COST

\$0.00

REPLACEMENT COSTS

\$0.00

TOTAL COSTS

\$0.00

-----MANAGEMENT PLAN RECOMMENDATION-----

RECOMMENDED RESPONSE ACTION:

N/A

PRIORITY:

N/A

PREVENTIVE MEASURES:

See O&M Section: N/A

LEA RESPONSE:

ACTION ELECTION: N/A

RESPONSE ACTION SCHEDULE

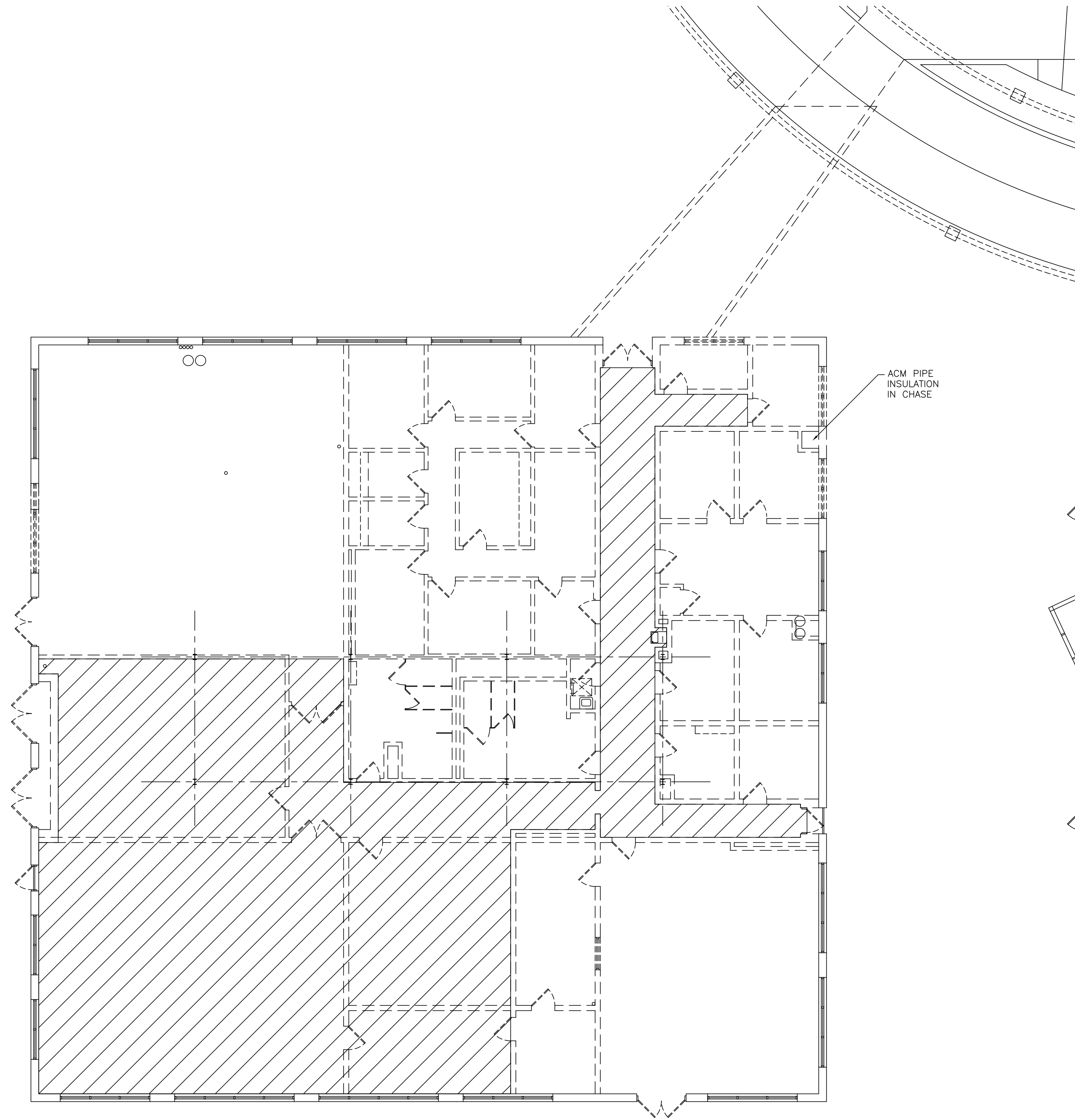
START DATE

N/A

COMPLETION DATE

N/A

LEA COMMENTS:



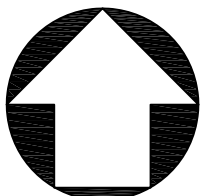
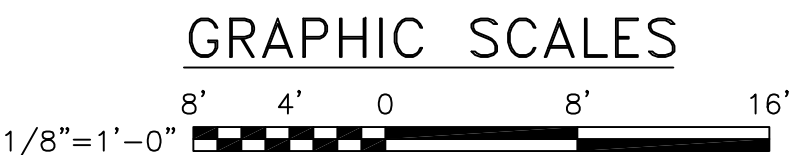
DEMOLITION FLOOR PLAN  
SCALE: 1/8"=1'-0"

NOTES:  
1. ALL LOCATIONS AND AMOUNT OF ACM ARE APPROXIMATE.  
2. CONTRACTOR TO VERIFY EXISTING CONDITIONS.

**ASBESTOS DISCLOSURE STATEMENT:**  
AN ASBESTOS INSPECTION WAS PERFORMED AND ASBESTOS-CONTAINING MATERIALS WERE FOUND GENERALLY IN THE AREAS INDICATED. THE ASBESTOS REPORT IS ACALABLE TO THE CONTRACTOR(S) FOR HIS INFORMATION. THE ASBESTOS-CONTAINING MATERIALS SHALL BE REMOVED PRIOR TO ANY OTHER WORK BEING PERFORMED IN THESE AREAS. THE ASBESTOS MANAGEMENT PLAN IS INCLUDED IN THE DOCUMENTS. THE ASBESTOS ABATEMENT CONTRACTOR SHALL MARK UP THE ASBESTOS MANAGEMENT PLAN TO SHOW THE "AS BUILT" CONDITIONS RESULTING FROM ITS WORK TO INCLUDE AREAS WHERE ASBESTOS WAS ABATED WHERE ASBESTOS WAS ENCAPSULATED, AND AREAS WHERE ASBESTOS-CONTAINING MATERIALS EXIST BUT WERE LEFT IN PLACE.

**LEAD-BASED PAINT DISCLOSURE STATEMENT:**  
A LEAD-BASED PAINT INSPECTION WAS PERFORMED AND LEAD-BASED PAINT WAS FOUND IN THE AREAS INDICATED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLIANCE WITH ALL REQUIREMENTS OF THE VIRGINIA OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION REGULATIONS REGARDING LEAD-BASED PAINT PROTECTION FOR WORKERS.

ASBESTOS LEGEND	
SYMBOL	DESCRIPTION
	FLOOR TILE & MASTIC



REV	DATE	DESCRIPTION	APP
	01/28/08	AS-BUILT	BCM

COMM NO: 50234D  
ISSUE DATE: 18 MAY 2005  
DESIGNED BY: RHN DRAWN BY: DJM  
CHECKED BY: RHN SUBMITTED BY: BCM



# **Commissioning Plan**

**Renovate Chapman Hall Enrollment Center  
Virginia Western Community College  
Roanoke, VA**

**VIRGINIA  
WESTERN**

**May 23, 2025**

**State Project Code #260-B5260-019 (L24VW573)**

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## 1. General Building Summary

Project Name	Renovate Chapman Hall Enrollment Center
State Project Number	#260-B5260-019 (L24VW573)
Project Address	Chapman Hall Virginia Western Community College 3094 Colonial Ave SW Roanoke, VA 24015
Building Type	Higher Ed - Admin
Square Footage	9,560 square feet of renovated floor area
Building Description	Higher Ed (Administration)
Owner Agency	Virginia Community College System (Mike Jones)
Scheduled Completion Date	End-of-year 2025

Chapman Hall, serving as Virginia Western's main student enrollment center, built in 1961 and last renovated in 2005, no longer meets modern space and technological requirements. The proposed project aims to redesign the interior to improve the student enrollment experience. Approximately 69% of the gross floor area will be renovated, and will include Civil, Arch, Struct, MEP and Comm/Data systems.

The project includes the replacement and upgrades to the existing variable air volume system, lighting controls, plumbing systems, exhaust fans, and all associated HVAC controls. The project is expected to improve the student enrollment experience and to create an excellent first impression for new students.

## 2. Overview

### 2.1 Abbreviations and Definitions

The following are common abbreviations used in this document.

A/E	Architect and design engineers	FPT	Functional performance test
CP	Commissioning provider	GC	General contractor
CC	Controls contractor	MC	Mechanical contractor
CX	Commissioning	PF	Pre-functional checklist
EM	Energy Manager	Staff	Maintenance Staff
CX Plan	Commissioning Plan document	Subs	Subcontractors to General
EC	Electrical contractor	TAB	Test and balance contractor
MM	Maintenance Manager	PM	Project Manager

### 2.2 Purpose of the Commissioning Plan

The purpose of the commissioning plan is to provide direction for the commissioning process during construction, providing resolution for issues such as scheduling, roles and responsibilities, lines of communication and reporting, approvals, and coordination.

### 2.3 Commissioning Goals and Objectives

Best Engineering's commissioning is a systematic process of ensuring that the building systems perform according to the design intent and the owner's operational requirements. All equipment and systems should be installed according to manufacturer's recommendations and the best practices and standards of the industry.

Commissioning will include documenting the design intent, followed by activities in the construction, acceptance, and warranty phases of the project. The participation of the contractors in commissioning activities will follow the requirements defined in the specifications. The three main goals of the commissioning process are:

1. Facilitate the final acceptance of the project at the earliest possible date.
2. Facilitate the transfer of the project to the owner's maintenance staff.
3. Ensure that the comfort systems meet the requirements of the occupants.

Commissioning is also intended to achieve the following specific objectives:

- Document that equipment is installed and started per manufacturer's recommendations.
- Document that equipment and systems receive complete operational checkout by installing contractors.
- Document system performance with thorough functional performance testing and monitoring.
- Verify the completeness of operations and maintenance materials.
- Ensure that the owner's operating personnel are adequately trained on the operation and maintenance of building equipment.

### 2.4 Commissioning Scope

The table below shows the general scope of the commissioning for this project. Specific equipment and detailed descriptions of each task can be found in Section 4.

Pre-Construction	
1	Prepare a commissioning plan.
2	Attend commissioning kick-off meeting to present the commissioning plan and review roles and responsibilities.
3	Develop commissioning specifications for inclusion in bid documents (i.e. contractor requirements).
4	Review and confirm that the Design Documents (approx. 95% Construction Documents) meet the intent of the Owner's Project Requirements (OPR) (a limited, cursory review will be provided).
5	Perform the tasks and functions in the specifications ascribed to the Commissioning Provider (as provided by Best Engineering).
6	Coordinate and direct the commissioning activities.
7	Ensure that commissioning activities are included in Construction Schedules.
8	Provide backcheck at 100% Construction Documents of any items updated or modified as a result of the initial design review. (Cursory review only).
Construction	
1	Revise the construction-phase Commissioning plan as needed.

2	Schedule, plan and conduct construction-phase commissioning meetings as required for job observation, witnessing start-up, reviewing TAB, etc.
3	Request and review additional information required for commissioning, such as O&M materials, contractor start-up procedures, control sequences, etc.
4	Prepare final functional verification test procedures (FTP) tailored specifically to the installed HVAC equipment and systems and associated controls.
5	Prepare final functional verification test procedures (FTP) tailored specifically to the installed lighting controls systems, such as occupancy sensors and daylight harvesting.
6	Prepare final functional verification test procedures (FTP) tailored specifically to domestic water heating systems, such as new tempering valves.
7	Prepare final functional verification test procedures (FTP) tailored specifically to systems adjusting and balancing verification.
8	Review change orders and requests for information pertaining to Commissioned systems.
9	Perform site visits as necessary to observe component and systems installations.
10	Attend Pre-Construction Conference and review construction progress meeting minutes.
11	Review HVAC piping pressure testing and flushing reports.
12	Document systems startup via review of reports and observation.
13	Review air and water systems balancing via spot checking, review of reports and selected site observation.
14	Analyze functional test trend logs and monitoring data to verify performance (up to 6 months post-occupancy).
15	Coordinate, witness, and document manual functional performance testing with contractor. Point-to-point and sequence checkout will be performed for all systems commissioned. Assumes the controls contractor will be available on site to provide access and manipulate data points during testing. MEP subcontractors shall be on-site or on-call to answer field questions during testing. (1 round of testing completed in a consecutive block of days)
16	Maintain a master issues log and separate record of functional testing and report all issues to contractor. Deliverable will be in the form of a spreadsheet Issues Log.
17	Verify the training of Authorized Users' operating and maintenance personnel.
18	Review the preparation of O&M manuals for commissioned equipment and systems.
19	Follow up on the corrections by retesting systems (or components) which failed the first verification test. Additional retesting excluded. Assumes the controls contractor will be available on-site to provide access and manipulate data points during testing. Relevant subcontractors shall be on-site or on-call to answer field questions during testing. (1 round of testing completed in a consecutive block of days)
20	Compile a comprehensive Commissioning Record, consisting of Summary Report, listing of non-compliance items with recommendations for correction, and additional reports, logs, plans, reviews compiled during the commissioning activities, including the signed-off and executed testing procedures.

**3. Commissioning Team Information**

Function	Name/Address	Contact Information
Owner Contact(s)	<p>Mike Jones, MBA Capital Outlay Program Manger Virginia's Community Colleges- System Office 300 Arboretum Place, Suite 200 Richmond, VA 23236 <a href="mailto:mjones@vccs.edu">mjones@vccs.edu</a></p> <p>Reginald A. Walker, RA, LEED AP Project Manager, Facilities Planning and Development Virginia Western Community College 3099 Colonial Avenue, SW (Room M230) Roanoke, VA 24015 <a href="mailto:RWalker@virginiawestern.edu">RWalker@virginiawestern.edu</a></p> <p>Kevin Witter Director of Facilities, Planning &amp; Development Business Science M230 Virginia Western Community College <a href="mailto:kwitter@virginiawestern.edu">kwitter@virginiawestern.edu</a></p>	<p>Phone: (832) 428-4678</p> <p>Phone: (540) 239-5595 (540) 857-6456</p> <p>Phone: (540) 857-6481</p>
Architect / MEP Engineer	<p>Nathan Harper, AIA, Principal Spectrum Design, PC 10 Church Ave SE Ste 1 Roanoke, VA 24011 <a href="mailto:nharper@spectrumpc.com">nharper@spectrumpc.com</a></p> <p>Mike Rakes (Structural / Electrical contact) Spectrum Design, PC <a href="mailto:mrakes@spectrumpc.com">mrakes@spectrumpc.com</a></p> <p>John N Berg Jr, PE (Mech/Plumbing) Stottsberg Engineering PO Box 876 Fincastle, VA 24090 <a href="mailto:john@stottsbergeng.com">john@stottsbergeng.com</a></p>	<p>Phone: (540) 342-6001</p> <p>Phone: (540) 216-0331</p>
Commissioning Provider	<p>J.D. Best, PE, BCxP Best Engineering, PLC 2725 Guilford Ave. SW Roanoke, VA 24015 <a href="mailto:jd@best-engineers.com">jd@best-engineers.com</a></p>	<p>Phone: (540) 339-6188</p>
General Contractor	TBD	Phone:
MEP Contractor	TBD	Phone:
Campus BAS Provider	<p>Nick Gosslin, President BAS Control Systems 8420 Meadowbridge Rd., Suite C Mechanicsville, VA 23116 <a href="mailto:ngosslin@bas-cs.com">ngosslin@bas-cs.com</a></p>	<p>Phone: (804) 569-2473</p>
Electrical Contractor	TBD	Phone:
TAB Contractor	TBD	Phone:

## **4. Roles and Responsibilities**

### **General Management Plan**

In general, the Commissioning Provider (CP) coordinates the commissioning activities and reports to the owner's construction representative. The CP's responsibilities, along with all other contractors' commissioning responsibilities are detailed in the specifications. The Specifications will take precedence over this Commissioning Plan. All members work together to fulfill contracted responsibilities and meet the objectives of the Contract Documents.

### **4.1 General Descriptions of Roles**

General descriptions of the commissioning roles are as follows:

- CP: Coordinates the CX process, writes and/or reviews testing plans, directs and documents performance testing.
- PM: Facilitates and supports the CX process and gives final approval of the CX work.
- MM: Coordinates maintenance staff participation in commissioning activities.
- GC: Facilitates the CX process, ensures that Subs perform their responsibilities and integrates CX into the construction process and schedule.
- Subs: Demonstrate correct system performance.
- Staff: Participate in commissioning tasks and performance testing, review O&M documentation, and attend training.
- A/E: Perform construction observation, approve O&M manuals and assist in resolving problems.
- Mfr.: Equipment manufacturers and vendors provide documentation to facilitate the commissioning work and perform contracted startup.

## 4.2 General Management Plan and Protocols

The following protocols will be used on this project.

Issue	Protocol
For requests for information (RFI) or formal documentation requests:	The CP goes first through the PM.
For minor or verbal information and clarifications:	The CP goes direct to the informed party.
For notifying contractors of deficiencies:	The CP documents deficiencies through the PM, but may discuss deficiency issues with contractors prior to notifying the PM.
For scheduling functional tests or training:	The CP provides input and coordination of testing and training. Scheduling is done through the PM.
For scheduling commissioning meetings:	The CP selects the date and schedules through the PM.
For making a request for significant changes:	The CP has no authority to issue change orders.
For making minor changes in specified sequences of operations:	Any required changes in sequences of operations required to correct operational deficiencies must be approved and documented by the PM and A/E team. The CP may recommend to the PM changes in sequences of operation to improve efficiency or control.
Subcontractors disagreeing with requests or interpretations by the CP shall:	Resolve issues at the lowest level possible. First with the CP, then with the GC and PM. Some issues may require input from the A/E team.

## 5. Commissioning Process

This section outlines the commissioning equipment scope and specific tasks.

### Systems to be Commissioned

The following systems, including all components and controls, are assumed to be commissioned under the proposed scope of work:

- Removal and replacement of HVAC in Chapman Hall, including:
  - Rooftop air handling unit
  - Exhaust fans
  - VAV boxes w/ HW reheat
  - Associated ductwork
- Lighting Controls
- Limited plumbing
- BMS / controls upgrades

Specifically, the following marked systems will be commissioned in this project:

System	Equipment	QTY	Sample Rate
<b>HVAC Systems</b>			
	New or existing rooftop air handling unit (TBD)	1	100%
	New and existing VAV terminal boxes	TBD	>50%*
	Misc. exhaust fans	TBD	100%
	Test, adjust, balancing (TAB) associated with the work.	N/A	100%
	BMS / controls upgrades	N/A	100%
	Integration w/ existing HHW and CHW systems, if applicable	N/A	100%
<b>Electrical</b>			
	Lighting controls – Occupancy Sensors	N/A	100%
	Lighting controls – Networked scheduling	N/A	100%
<b>Plumbing</b>			
	(1) tempering valve	1	100%

\*100% of boxes will be tested at the BAS front-end.

The following are excluded from the commissioning scope at this time:

- Demolition-phase work
- Building envelope, plumbing, & electrical systems, & exterior lighting
- Heating hot water or chilled water distribution systems beyond the building envelope
- Emergency generators
- Plumbing and electrical systems beyond that listed above
- Central plant

The following provides further detail/specifics for tasks and activities in the commissioning process:

## **The Commissioning Plan**

The commissioning plan is a document used to communicate to the other team members the commissioning process; requirements of each team member; and responsible party and schedule. Plan includes sample copies of all commissioning check sheets and forms to be used on project. The plan is presented in the kick-off meeting and updated periodically throughout process.

## **Commissioning Kickoff Meeting**

Kickoff meeting brings together all members of the design, construction, and operations team that will be involved in the commissioning process. Each building system to be commissioned is addressed, including commissioning requirements, and completion and start-up schedules. During the scoping meeting, all parties agree on the scope of work, tasks, schedules, deliverables, and responsibilities for implementation of the Commissioning Plan.

## **Design Review (Cursory)**

Constructability, maintainability, operability and functionality are the main focus of the design review. Best Engineering reviews the design documents to facilitate commissioning during construction. Many of the features that facilitate commissioning will also enhance ease of building operation.

## **Commissioning Specifications**

The specifications clearly identify the roles and responsibilities of each party, including the contractor, in the commissioning process. We will review and/or provide commissioning specifications specific to the project to ensure that the tasks are accurately reflected in the contract documents for each discipline.

## **Development of Functional Test and Verification Procedures**

Functional performance testing verifies the intended operation of individual components and system interactions under various conditions and modes of operation. The systems are run through all sequences of operation and the response of components is verified. Testing proceeds from components to subsystems to systems, and finally to interlocks and connections between systems.

The commissioning agent prepares functional performance test (FPT) plans so that the complete sequence of operations is included. The commissioning agent obtains all documentation, including an updated points list, control sequences, and setpoints. Prior to execution, the commissioning agent provides a copy of the primary equipment tests to the installing subcontractor and general contractor who can review the tests for feasibility, safety, warranty and equipment protection.

## **Submittals**

The general contractor will provide the commissioning agent with a set of equipment and system submittals. This equipment data includes installation and start-up procedures, O&M data, performance data and temperature control drawings. The subcontractors, general contractor or A/E notify the commissioning agent of any new design intent or operating parameter changes, added control strategies and sequences of operation, or other change orders that may affect commissioned systems.

## **Test and Balance (TAB) Verification**

Testing and balancing is a pre-requisite to commissioning. Best Engineering reviews TAB in detail to ensure compliance with the commissioning specifications and contract documents. We spot verify readings on-site to confirm accuracy. We also work collaboratively with TAB

technicians to review their equipment, procedures, and results. Process results in a streamlined approach and more robust results at a lower cost to the Owner.

### **Execution of Functional Testing Procedures**

The commissioning agent schedules point-to-point checkout and functional tests through the general contractor and subcontractors. Under the supervision of the commissioning agent, the installing subcontractor performs the hardware and/or software manipulations required for the testing. Owner maintenance staff will also be present in order to assist in system observations. The commissioning agent witnesses and records the results of functional performance testing. Any deficiencies found from functional performance testing will be documented in a Preliminary Report, and also included in the Final Report. The report will include all details of the components or systems found to be non-compliant with the parameters of the functional performance test plans and design documents. The deficiency report will become part of the punch list. The report will detail the adjustments or alterations required to correct the system operation, and to identify the responsible party. The deficiency report will be continuously updated. The commissioning agent schedules any required retesting through the general contractor. Decisions regarding deficiencies and corrections are made at as low a level as possible, preferably between commissioning agent, sub-contractor and general contractor.

### **Record Drawings and Operations and Maintenance Manuals**

Review of record drawings and O&M manuals for completeness, clarity, and ease of locating warranty information. Contractors are required to submit O&M manuals at the earliest possible date immediately following approval of all submittals, allowing for a more complete manual and better pre-functional and functional testing documentation. Additional information is added and requested from the contractors, to stressing and enhancing the importance of system interactions, troubleshooting, and long-term preventative maintenance and operation. A database of preventative maintenance information will be created from the materials in the O&M manuals.

### **Commissioning Report**

Final Commissioning Report will be compiled summarizing all tasks, findings, and documentation of the commissioning process. Report will address the actual performance of the building systems in reference to the design documents. All test reports by various sub-contractors, manufacturers and controlling authorities will be incorporated into the final report.

The commissioning report includes:

- An evaluation of the operating condition of the systems at the time of functional test completion,
- Deficiencies that were discovered and the measures taken to correct them,
- Functional test procedures and results,
- Reports that document all commissioning field activities as they progressed, and
- A description and estimated schedule of required deferred testing.

## **6. Schedule**

### **6.1 General Issues**

The following sequential priorities are followed:

1. Equipment is not “temporarily” started (for heating or cooling), until pre-start checklist items and all manufacturers’ pre-start procedures are completed and moisture, dust and other environmental and building integrity issues have been addressed.
2. Functional performance testing does not begin until pre-functional, start-up and TAB is completed for a given system and all engineer punch lists are completed.
3. The controls system and equipment controls are not functionally tested until all points have been calibrated and pre-functional checklists are completed.
4. Substantial completion is not granted until all training and O&M documentation are complete and reviewed by all parties. (see below)

### **6.2 Project Schedule**

Construction for the project is anticipated to start in fall of 2025, and to be finished by the end of 2025.

A single round of testing will be completed in a consecutive block of days, followed by a round of back-testing to ensure deficiencies have been corrected.

Obviously, the construction schedule should allow enough time for testing at the end of each phase and prior to occupancy. We will work closely with the contractor as this time approaches to coordinate the testing schedule and help facilitate timely handover of the building.

## **7. APPENDIX**

Sample functional testing forms are shown below. Actual forms will be provided for team review prior to testing.