

# PROJECT MANUAL FOR

WESTERN CAROLINA UNIVERSITY  
STILLWELL BUILDING BACKFILL RENOVATION  
SCO ID# 16-15506-04D  
Cullowhee, North Carolina

## BID SET

October 7, 2021

· Lord Aeck Sargent Planning & Design, Inc. ·  
*Architects*

· PFA Architects, PA. ·  
*Associate Architects*

· Affiliated Engineers, Inc. ·  
*Mechanical, Electrical and Plumbing and Fire Protection Engineers*





SECTION 00 01 07 - ARCHITECTURAL

ARCHITECTURAL

Lord Aeck Sargent Planning & Design, Inc.  
1450 Raleigh Road  
Suite 109  
Chapel Hill, NC. 27517



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SECTION 00 01 07 - ARCHITECTURAL

ARCHITECTURAL

PFA Architects  
196 Coxe Avenue  
Asheville, NC 28801



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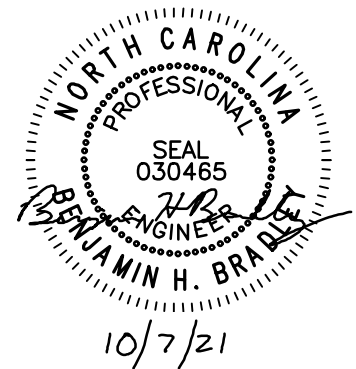
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1414 Raleigh Road  
Chapel Hill, NC 27517  
Corporate Charter #M89165

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**INSTRUCTIONS TO BIDDERS  
AND  
GENERAL CONDITIONS OF THE CONTRACT**

**STANDARD FORM FOR CONSTRUCTION PROJECTS**

**STATE CONSTRUCTION OFFICE  
NORTH CAROLINA  
DEPARTMENT OF ADMINISTRATION**

**Form OC-15**

**This document is intended for use on State capital construction projects and shall not be used on any project that is not reviewed and approved by the State Construction Office. Extensive modification to the General Conditions by means of “Supplementary General Conditions” is strongly discouraged. State agencies and institutions may include special requirements in “Division 1 – General Requirements” of the specifications, where they do not conflict with the General Conditions.**

**Twenty Fourth Edition January 2013**

## **INSTRUCTIONS TO BIDDERS**

**For a proposal to be considered it must be in accordance with the following instructions:**

### **1. PROPOSALS**

Proposals must be made in strict accordance with the Form of Proposal provided therefor, and all blank spaces for bids, alternates, and unit prices applicable to bidder's work shall be properly filled in. When requested alternates are not bid, the proposer shall so indicate by the words "No Bid". Any blanks shall also be interpreted as "No Bid". The bidder agrees that bid on Form of Proposal detached from specifications will be considered and will have the same force and effect as if attached thereto. Photocopied or faxed proposals will not be considered. Numbers shall be stated both in writing and in figures for the base bids and alternates. If figures and writing differ, the written number will supersede the figures.

Any modifications to the Form of Proposal (including alternates and/or unit prices) will disqualify the bid and may cause the bid to be rejected.

The bidder shall fill in the Form of Proposal as follows:

- a. If the documents are executed by a sole owner, that fact shall be evidenced by the word "Owner" appearing after the name of the person executing them.
- b. If the documents are executed by a partnership, that fact shall be evidenced by the word "Co-Partner" appearing after the name of the partner executing them.
- c. If the documents are executed on the part of a corporation, they shall be executed by either the president or the vice president and attested by the secretary or assistant secretary in either case, and the title of the office of such persons shall appear after their signatures. The seal of the corporation shall be impressed on each signature page of the documents.
- d. If the proposal is made by a joint venture, it shall be executed by each member of the joint venture in the above form for sole owner, partnership or corporation, whichever form is applicable.
- e. All signatures shall be properly witnessed.
- f. If the contractor's license of a bidder is held by a person other than an owner, partner or officer of a firm, then the licensee shall also sign and be a party to the proposal. The title "Licensee" shall appear under his/her signature.

Proposals should be addressed as indicated in the Advertisement for Bids and be delivered, enclosed in an opaque sealed envelope, marked "Proposal" and bearing the title of the work, name of the bidder, and the contractor's license number of the bidder. Bidders should clearly mark on the outside of the bid envelope which contract(s) they are bidding.

Bidder shall identify on the bid, the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit listing good faith efforts or an affidavit indicating work under contract will be self-performed, as required by G.S. 143-128.2(c) and G.S. 143-128.2(f). Failure to comply with these requirements is grounds for rejection of the bid.

For projects bid in the single-prime alternative, the names and license numbers of major subcontractors shall be listed on the proposal form.

It shall be the specific responsibility of the bidder to deliver his bid to the proper official at the selected place and prior to the announced time for the opening of bids. Later delivery of a bid for any reason, including delivery by any delivery service, shall disqualify the bid.

Unit prices quoted in the proposal shall include overhead and profit and shall be the full compensation for the contractor's cost involved in the work. See General Conditions, Article 19c-1.

## **2. EXAMINATION OF CONDITIONS**

It is understood and mutually agreed that by submitting a bid the bidder acknowledges that he has carefully examined all documents pertaining to the work, the location, accessibility and general character of the site of the work and all existing buildings and structures within and adjacent to the site, and has satisfied himself as to the nature of the work, the condition of existing buildings and structures, the conformation of the ground, the character, quality and quantity of the material to be encountered, the character of the equipment, machinery, plant and any other facilities needed preliminary to and during prosecution of the work, the general and local conditions, the construction hazards, and all other matters, including, but not limited to, the labor situation which can in any way affect the work under the contract, and including all safety measures required by the Occupational Safety and Health Act of 1970 and all rules and regulations issued pursuant thereto. It is further mutually agreed that by submitting a proposal the bidder acknowledges that he has satisfied himself as to the feasibility and meaning of the plans, drawings, specifications and other contract documents for the construction of the work and that he accepts all the terms, conditions and stipulations contained therein; and that he is prepared to work in cooperation with other contractors performing work on the site.

Reference is made to contract documents for the identification of those surveys and investigation reports of subsurface or latent physical conditions at the site or otherwise affecting performance of the work which have been relied upon by the designer in preparing the documents. The owner will make copies of all such surveys and reports available to the bidder upon request.

Each bidder may, at his own expense, make such additional surveys and investigations as he may deem necessary to determine his bid price for the performance of the work. Any on-site investigation shall be done at the convenience of the owner. Any reasonable request for access to the site will be honored by the owner.

## **3. BULLETINS AND ADDENDA**

Any addenda to specifications issued during the time of bidding are to be considered covered in the proposal and in closing a contract they will become a part thereof. It shall be the bidder's responsibility to ascertain prior to bid time the addenda issued and to see that his bid includes any changes thereby required.

Should the bidder find discrepancies in, or omission from, the drawings or documents or should he be in doubt as to their meaning, he shall at once notify the designer who will send written instructions in the form of addenda to all bidders. Notification should be no later than seven (7) days prior to the date set for receipt of bids. Neither the owner nor the designer will be responsible for any oral instructions.

All addenda should be acknowledged by the bidder(s) on the Form of Proposal. However, even if not acknowledged, by submitting a bid, the bidder has certified that he has reviewed all issued addenda and has included all costs associated within his bid.

#### **4. BID SECURITY**

Each proposal shall be accompanied by a cash deposit or a certified check drawn on some bank or trust company insured by the Federal Deposit Insurance Corporation, or a bid bond in an amount equal to not less than five percent (5%) of the proposal, said deposit to be retained by the owner as liquidated damages in event of failure of the successful bidder to execute the contract within ten (10) days after the award or to give satisfactory surety as required by law (G.S. 143-129).

Bid bond shall be conditioned that the surety will, upon demand, forthwith make payment to the obligee upon said bond if the bidder fails to execute the contract. The owner may retain bid securities of any bidder(s) who may have a reasonable chance of award of contract for the full duration of time stated in the Notice to Bidders. Other bid securities may be released sooner, at the discretion of the owner. All bid securities (cash or certified checks) shall be returned to the bidders promptly after award of contracts, and no later than seven (7) days after expiration of the holding period stated in the Notice to Bidders. Standard Form of Bid Bond is included in these specifications and shall be used.

#### **5. RECEIPT OF BIDS**

Bids shall be received in strict accordance with requirements of the General Statutes of North Carolina. Bid security shall be required as prescribed by statute. Prior to the closing of the bid, the bidder will be permitted to change or withdraw his bid. Guidelines for opening of public construction bids are available from the State Construction Office.

#### **6. OPENING OF BIDS**

Upon opening, all bids shall be read aloud. Once bidding is closed, there shall not be any withdrawal of bids by any bidder and no bids may be returned by the designer to any bidder. After the opening of bids, no bid may be withdrawn, except under the provisions of General Statute 143-129.1, for a period of thirty days unless otherwise specified. Should the successful bidder default and fail to execute a contract, the contract may be awarded to the next lowest and responsible bidder. The owner reserves the unqualified right to reject any and all bids. Reasons for rejection may include, but shall not be limited to, the following:

- a. If the Form of Proposal furnished to the bidder is not used or is altered.
- b. If the bidder fails to insert a price for all bid items, alternate and unit prices requested.
- c. If the bidder adds any provisions reserving the right to accept or reject any award.
- d. If there are unauthorized additions or conditional bids, or irregularities of any kind which tend to make the proposal incomplete, indefinite or ambiguous as to its meaning.
- e. If the bidder fails to complete the proposal form where information is requested so the bid may be properly evaluated by the owner.
- f. If the unit prices contained in the bid schedule are unacceptable to the owner and the State Construction Office.
- g. If the bidder fails to comply with other instructions stated herein.

## **7. BID EVALUATION**

The award of the contract will be made to the lowest responsible bidder as soon as practical. The owner may award on the basis of the base bid and any alternates the owner chooses.

Before awarding a contract, the owner may require the apparent low bidder to qualify himself to be a responsible bidder by furnishing any or all of the following data:

- a. The latest financial statement showing assets and liabilities of the company or other information satisfactory to the owner.
- b. A listing of completed projects of similar size.
- c. Permanent name and address of place of business.
- d. The number of regular employees of the organization and length of time the organization has been in business under present name.
- e. The name and home office address of the surety proposed and the name and address of the responsible local claim agent.
- f. The names of members of the firms who hold appropriate trade licenses, together with license numbers.
- g. If prequalified, contractor info will be reviewed and evaluated comparatively to submitted prequalification package.

Failure or refusal to furnish any of the above information, if requested, shall constitute a basis for disqualification of any bidder.

In determining the lowest responsible, responsive bidder, the owner shall take into consideration the bidder's compliance with the requirements of G.S. 143-128.2(c), the past performance of the bidder on construction contracts for the State with particular concern given to completion times, quality of work, cooperation with other contractors, and cooperation with the designer and owner. Failure of the low bidder to furnish affidavit and/or documentation as required by G.S. 143-128.2(c) shall constitute a basis for disqualification of the bid.

Should the owner adjudge that the apparent low bidder is not the lowest responsible, responsive bidder by virtue of the above information, said apparent low bidder will be so notified and his bid security shall be returned to him.

## **8. PERFORMANCE BOND**

The successful bidder, upon award of contract, shall furnish a performance bond in an amount equal to 100 percent of the contract price. See Article 35, General Conditions.

## **9. PAYMENT BOND**

The successful bidder, upon award of contract, shall furnish a payment bond in an amount equal to 100 percent of the contract price. See Article 35, General Conditions.

## 10. PAYMENTS

Payments to the successful bidders (contractors) will be made on the basis of monthly estimates. See Article 31, General Conditions.

## 11. PRE-BID CONFERENCE

Prior to the date set for receiving bids, the Designer may arrange and conduct a Pre-Bid Conference for all prospective bidders. The purpose of this conference is to review project requirements and to respond to questions from prospective bidders and their subcontractors or material suppliers related to the intent of bid documents. Attendance by prospective bidders shall be as required by the "Notice to Bidders".

## 12. SUBSTITUTIONS

In accordance with the provisions of G.S. 133-3, material, product, or equipment substitutions proposed by the bidders to those specified herein can only be considered during the bidding phase until ten (10) days prior to the receipt of bids when submitted to the Designer with sufficient data to confirm material, product, or equipment equality. Proposed substitutions submitted after this time will be considered only as potential change order.

Submittals for proposed substitutions shall include the following information:

- a. Name, address, and telephone number of manufacturer and supplier as appropriate.
- b. Trade name, model or catalog designation.
- c. Product data including performance and test data, reference standards, and technical descriptions of material, product, or equipment. Include color samples and samples of available finishes as appropriate.
- d. Detailed comparison with specified products including performance capabilities, warranties, and test results.
- e. Other pertinent data including data requested by the Designer to confirm product equality.

If a proposed material, product, or equipment substitution is deemed equal by the Designer to those specified, all bidders of record will be notified by Addendum.

## GENERAL CONDITIONS OF THE CONTRACT

The use or reproduction of this document or any part thereof is authorized for and limited to use on projects of the State of North Carolina, and is distributed by, through and at the discretion of the State Construction Office, Raleigh, North Carolina, for that distinct and sole purpose.

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## ARTICLE 1 - DEFINITIONS

- a. The **contract documents** consist of the Notice to Bidders; Instructions to Bidders; General Conditions of the Contract; special conditions if applicable; Supplementary General Conditions; the drawing and specifications, including all bulletins, addenda or other modifications of the drawings and specifications incorporated into the documents prior to their execution; the proposal; the contract; the performance bond; the payment bond; insurance certificates; the approval of the attorney general; and the certificate of the Office of State Budget and Management. All of these items together form the contract.
- b. The **owner** is the State of North Carolina through the agency named in the contract.
- c. The **designer(s)** are those referred to within this contract, or their authorized representatives. The Designer(s), as referred to herein, shall mean architect and/or engineer. They will be referred to hereinafter as if each were of the singular number, masculine gender.
- d. The **contractor**, as referred to hereinafter, shall be deemed to be either of the several contracting parties called the "Party of the First Part" in either of the several contracts in connection with the total project. Where, in special instances hereinafter, a particular contractor is intended, an adjective precedes the word "contractor," as "general," "heating," etc. For the purposes of a single prime contract, the term Contractor shall be deemed to be the single contracting entity identified as the "Party of the First Part" in the single Construction Contract. Any references or adjectives that name or infer multiple prime contractors shall be interpreted to mean the single prime Contractor.
- e. A **subcontractor**, as the term is used herein, shall be understood to be one who has entered into a direct contract with a contractor, and includes one who furnishes materials worked to a special design in accordance with plans and specifications covered by the contract, but does not include one who only sells or furnishes materials not requiring work so described or detailed.
- f. **Written notice** shall be defined as notice in writing delivered in person to the contractor, or to a partner of the firm in the case of a partnership, or to a member of the contracting organization, or to an officer of the organization in the case of a corporation, or sent to the last known business address of the contracting organization by registered mail.
- g. **Work**, as used herein as a noun, is intended to include materials, labor, and workmanship of the appropriate contractor.
- h. The **project** is the total construction work to be performed under the contract documents by the several contractors.
- i. **Project Expediter**, as used herein, is an entity stated in the contract documents, designated to effectively facilitate scheduling and coordination of work activities. See Article 14(f) for responsibilities of a Project Expediter. **For the purposes of a single prime contract, the single prime contractor shall be designated as the Project Expediter.**
- j. **Change order**, as used herein, shall mean a written order to the contractor subsequent to the signing of the contract authorizing a change in the contract. The change order shall be signed by the contractor, designer and the owner, and approved by the State Construction Office, in that order (Article 19).

- k. **Field Order**, as used herein, shall mean a written approval for the contractor to proceed with the work requested by owner prior to issuance of a formal Change Order. The field order shall be signed by the contractor, designer, owner, and State Construction Office.
- l. **Time of completion**, as stated in the contract documents, is to be interpreted as consecutive calendar days measured from the date established in the written Notice to Proceed, or such other date as may be established herein (Article 23).
- m. **Liquidated damages**, as stated in the contract documents [, is an amount reasonably estimated in advance to cover the consequential damages associated with the Owner's economic loss in not being able to use the Project for its intended purposes at the end of the contract's completion date as amended by change order, if any, by reason of failure of the contractor(s) to complete the work within the time specified. Liquidated damages does not include the Owner's extended contract administration costs (including but not limited to additional fees for architectural and engineering services, testing services, inspection services, commissioning services, etc.), such other damages directly resulting from delays caused solely by the contractor, or consequential damages that the Owner identified in the bid documents that may be impacted by any delay caused solely by the Contractor (e.g., if a multi-phased project-subsequent phases, delays in start other projects that are dependent on the completion of this Project, extension of leases and/or maintenance agreements for other facilities).
- n. **Surety**, as used herein, shall mean the bonding company or corporate body which is bound with and for the contractor, and which engages to be responsible for the contractor and his acceptable performance of the work.
- o. **Routine written communications between the Designer and the Contractor** are any communication other than a "request for information" provided in letter, memo, or transmittal format, sent by mail, courier, electronic mail, or facsimile. Such communications can not be identified as "request for information".
- p. **Clarification or Request for information (RFI)** is a request from the Contractor seeking an interpretation or clarification by the Designer relative to the contract documents. The RFI, which shall be labeled (RFI), shall clearly and concisely set forth the issue or item requiring clarification or interpretation and why the response is needed. The RFI must set forth the Contractor's interpretation or understanding of the contract documents requirements in question, along with reasons for such an understanding.
- q. **Approval** means written or imprinted acknowledgement that materials, equipment or methods of construction are acceptable for use in the work.
- r. **Inspection** shall mean examination or observation of work completed or in progress to determine its compliance with contract documents.
- s. **"Equal to" or "approved equal"** shall mean materials, products, equipment, assemblies, or installation methods considered equal by the bidder in all characteristics (physical, functional, and aesthetic) to those specified in the contract documents. Acceptance of equal is subject to approval of Designer and owner.
- t. **"Substitution" or "substitute"** shall mean materials, products, equipment, assemblies, or installation methods deviating in at least one characteristic (physical, functional, or aesthetic) from those specified, but which in the opinion of the bidder would improve competition and/or enhance the finished installation. Acceptance of substitution is subject to the approval of the Designer and owner.

- u. **Provide** shall mean furnish and install complete in place, new, clean, operational, and ready for use.
- v. **Indicated and shown** shall mean provide as detailed, or called for, and reasonably implied in the contract documents.
- w. **Special inspector** is one who inspects materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with the approved construction documents and referenced standards.
- x. **Commissioning** is a quality assurance process that verifies and documents that building components and systems operate in accordance to the owner's project requirements and the project design documents.
- y. **Designer Final Inspection** is the inspection performed by the design team to determine the completeness of the project in accordance with approved plans and specifications. This inspection occurs prior to SCO final inspection.
- z. **SCO Final Inspection** is the inspection performed by the State Construction Office to determine the completeness of the project in accordance with NC Building Codes and approved plans and specifications.
- aa. **Beneficial Occupancy** is requested by the owner and is occupancy or partial occupancy of the building after all life safety items have been completed as determined by the State Construction Office. Life safety items include but not limited to fire alarm, sprinkler, egress and exit lighting, fire rated walls, egress paths and security.
- bb. Final Acceptance is the date in which the State Construction Office accepts the construction as totally complete. This includes the SCO Final Inspection and certification by the designer that all punch lists are completed.

## ARTICLE 2 - INTENT AND EXECUTION OF DOCUMENTS

- a. The drawings and specifications are complementary, one to the other, and that which is shown on the drawings or called for in the specifications shall be as binding as if it were both called for and shown. The intent of the drawings and specifications is to establish the scope of all labor, materials, transportation, equipment, and any and all other things necessary to provide a bid for a complete job. In case of discrepancy or disagreement in the contract documents, the order of precedence shall be: Form of Contract, specifications, large-scale detail drawings, small-scale drawings.
- b. The wording of the specifications shall be interpreted in accordance with common usage of the language except that words having a commonly used technical or trade meaning shall be so interpreted in preference to other meanings.
- c. The contractor shall execute each copy of the proposal, contract, performance bond and payment bond as follows:
  1. If the documents are executed by a sole owner, that fact shall be evidenced by the word "Owner" appearing after the name of the person executing them.
  2. If the documents are executed by a partnership, that fact shall be evidenced by the word "Co-Partner" appearing after the name of the partner executing them.

3. If the documents are executed on the part of a corporation, they shall be executed by either the president or the vice president and attested by the secretary or assistant secretary in either case, and the title of the office of such persons shall appear after their signatures. The seal of the corporation shall be impressed on each signature page of the documents.
4. If the documents are made by a joint venture, they shall be executed by each member of the joint venture in the above form for sole owner, partnership or corporation, whichever form is applicable to each particular member.
5. All signatures shall be properly witnessed.
6. If the contractor's license is held by a person other than an owner, partner or officer of a firm, then the licensee shall also sign and be a party to the contract. The title "Licensee" shall appear under his/her signature.
7. The bonds shall be executed by an attorney-in-fact. There shall be attached to each copy of the bond a certified copy of power of attorney properly executed and dated.
8. Each copy of the bonds shall be countersigned by an authorized individual agent of the bonding company licensed to do business in North Carolina. The title "Licensed Resident Agent" shall appear after the signature.
9. The seal of the bonding company shall be impressed on each signature page of the bonds.
10. The contractor's signature on the performance bond and the payment bond shall correspond with that on the contract. The date of performance and payment bond shall not be prior to the date of the contract.

### **ARTICLE 3 - CLARIFICATIONS AND DETAIL DRAWINGS**

- a. In such cases where the nature of the work requires clarification by the designer, such clarification shall be furnished by the designer with reasonable promptness by means of written instructions or detail drawings, or both. Clarifications and drawings shall be consistent with the intent of contract documents, and shall become a part thereof.
- b. The contractor(s) and the designer shall prepare, if deemed necessary, a schedule fixing dates upon which foreseeable clarifications will be required. The schedule will be subject to addition or change in accordance with progress of the work. The designer shall furnish drawings or clarifications in accordance with that schedule. The contractor shall not proceed with the work without such detail drawings and/or written clarifications.

### **ARTICLE 4 - COPIES OF DRAWINGS AND SPECIFICATIONS**

The designer or Owner shall furnish free of charge to the contractors electronic copies of plans and specifications. If requested by the contractor, paper copies of plans and specifications shall be furnished free of charge as follows:

- a. General contractor - Up to twelve (12) sets of general contractor drawings and specifications, up to six (6) sets of which shall include drawings and specifications of all other contracts, plus a clean set of black line prints on white paper of all appropriate drawings, upon which the contractor shall clearly and legibly record all work-in-place that is at variance with the contract documents.

- b. Each other contractor - Up to six (6) sets of the appropriate drawings and specifications, up to three (3) sets of which shall include drawings and specifications of all other contracts, plus a clean set of black line prints on white paper of all appropriate drawings, upon which the contractor shall clearly and legibly record all work-in-place that is at variance with the contract documents.
- c. Additional sets shall be furnished at cost, including mailing, to the contractor upon request by the contractor. This cost shall be stated in the bidding documents.
- d. For the purposes of a single-prime contract, the contractor shall receive up to 30 sets of drawings and specifications, plus a clean set of black line prints on white paper of all appropriate drawings, upon which the contractor shall clearly and legibly record all work-in-place that is at variance with the contract documents.

#### **ARTICLE 5 - SHOP DRAWINGS, SUBMITTALS, SAMPLES, DATA**

- a. Within 15 consecutive calendar days after the notice to proceed, each prime contractor shall submit a schedule for submission of all shop drawings, product data, samples, and similar submittals through the Project Expediter to the Designer. This schedule shall indicate the items, relevant specification sections, other related submittal, data, and the date when these items will be furnished to the designer.
- b. The Contractor(s) shall review, approve and submit to the Designer all Shop Drawings, Coordination Drawings, Product Data, Samples, Color Charts, and similar submittal data required or reasonably implied by the Contract Documents. Required Submittals shall bear the Contractor's stamp of approval, any exceptions to the Contract Documents shall be noted on the submittals, and copies of all submittals shall be of sufficient quantity for the Designer to retain up to three (3) copies of each submittal for his own use plus additional copies as may be required by the Contractor. Submittals shall be presented to the Designer in accordance with the schedule submitted in paragraph (a). so as to cause no delay in the activities of the Owner or of separate Contractors.
- c. The Designer shall review required submittals promptly, noting desired corrections if any, and retaining three (3) copies (1 for the Designer, 1 for the owner and 1 for SCO) for his use. The remaining copies of each submittal shall be returned to the Contractor not later than twenty (20) days from the date of receipt by the Designer, for the Contractor's use or for corrections and resubmittal as noted by the Designer. When resubmittals are required, the submittal procedure shall be the same as for the original submittals.
- d. Approval of shop drawings/submittals by the Designer shall not be construed as relieving the Contractor from responsibility for compliance with the design or terms of the contract documents nor from responsibility of errors of any sort in the shop drawings, unless such lack of compliance or errors first have been called in writing to the attention of the Designer by the Contractor.

#### **ARTICLE 6 - WORKING DRAWINGS AND SPECIFICATIONS AT THE JOB SITE**

- a. The contractor shall maintain, in readable condition at his job office, one complete set of working drawings and specifications for his work including all shop drawings. Such drawings and specifications shall be available for use by the designer, his authorized representative, owner or State Construction Office.

- b. The contractor shall maintain at the job office, a day-to-day record of work-in-place that is at variance with the contract documents. Such variations shall be fully noted on project drawings by the contractor and submitted to the designer upon project completion and no later than 30 days after final acceptance of the project.
- c. The contractor shall maintain at the job office a record of all required tests that have been performed, clearly indicating the scope of work inspected and the date of approval or rejection.

## **ARTICLE 7 - OWNERSHIP OF DRAWINGS AND SPECIFICATIONS**

All drawings and specifications are instruments of service and remain the property of the owner. The use of these instruments on work other than this contract without permission of the owner is prohibited. All copies of drawings and specifications other than contract copies shall be returned to the owner upon request after completion of the work.

## **ARTICLE 8 - MATERIALS, EQUIPMENT, EMPLOYEES**

- a. The contractor shall, unless otherwise specified, supply and pay for all labor, transportation, materials, tools, apparatus, lights, power, heat, sanitary facilities, water, scaffolding and incidentals necessary for the completion of his work, and shall install, maintain and remove all equipment of the construction, other utensils or things, and be responsible for the safe, proper and lawful construction, maintenance and use of same, and shall construct in the best and most workmanlike manner, a complete job and everything incidental thereto, as shown on the plans, stated in the specifications, or reasonably implied therefrom, all in accordance with the contract documents.
- b. All materials shall be new and of quality specified, except where reclaimed material is authorized herein and approved for use. Workmanship shall at all times be of a grade accepted as the best practice of the particular trade involved, and as stipulated in written standards of recognized organizations or institutes of the respective trades except as exceeded or qualified by the specifications.
- c. Upon notice, the contractor shall furnish evidence as to quality of materials.
- d. Products are generally specified by ASTM or other reference standard and/or by manufacturer's name and model number or trade name. When specified only by reference standard, the Contractor may select any product meeting this standard, by any manufacturer. When several products or manufacturers are specified as being equally acceptable, the Contractor has the option of using any product and manufacturer combination listed. However, the contractor shall be aware that the cited examples are used only to denote the quality standard of product desired and that they do not restrict bidders to a specific brand, make, manufacturer or specific name; that they are used only to set forth and convey to bidders the general style, type, character and quality of product desired; and that equivalent products will be acceptable. Request for substitution of materials, items, or equipment shall be submitted to the designer for approval or disapproval; such approval or disapproval shall be made by the designer prior to the opening of bids. Alternate materials may be requested after the award if it can clearly be demonstrated that it is an added benefit to the owner and the designer and owner approves.
- e. The designer is the judge of equality for proposed substitution of products, materials or equipment.

- g. If at any time during the construction and completion of the work covered by these contract documents, the language, conduct, or attire of any workman of the various crafts be adjudged a nuisance to the owner or designer, or if any workman be considered detrimental to the work, the contractor shall order such parties removed immediately from grounds.

#### **ARTICLE 9 - ROYALTIES, LICENSES AND PATENTS**

It is the intention of the contract documents that the work covered herein will not constitute in any way infringement of any patent whatsoever unless the fact of such patent is clearly evidenced herein. The contractor shall protect and save harmless the owner against suit on account of alleged or actual infringement. The contractor shall pay all royalties and/or license fees required on account of patented articles or processes, whether the patent rights are evidenced hereinafter.

#### **ARTICLE 10 - PERMITS, INSPECTIONS, FEES, REGULATIONS**

- a. The contractor shall give all notices and comply with all laws, ordinances, codes, rules and regulations bearing on the conduct of the work under this contract. If the contractor observes that the drawings and specifications are at variance therewith, he shall promptly notify the designer in writing. See Instructions to Bidders, Paragraph 3, Bulletins and Addenda. Any necessary changes required after contract award shall be made by change order in accordance with Article 19. If the contractor performs any work knowing it to be contrary to such laws, ordinances, codes, rules and regulations, and without such notice to the designer, he shall bear all cost arising therefrom. Additional requirements implemented after bidding will be subject to equitable negotiations.
- b. All work under this contract shall conform to the North Carolina State Building Code and other State, local and national codes as are applicable. The cost of all required inspections and permits shall be the responsibility of the contractor and included within the bid proposal. All water taps, meter barrels, vaults and impact fees shall be paid by the contractor unless otherwise noted.
- d. Projects constructed by the State of North Carolina or by any agency or institution of the State are not subject to inspection by any county or municipal authorities and are not subject to county or municipal building codes. The contractor shall, however, cooperate with the county or municipal authorities by obtaining building permits. Permits shall be obtained at no cost.
- e. Projects involving local funding (community colleges) are subject also to county and municipal building codes and inspection by local authorities. The contractor shall pay the cost of these permits and inspections.



## ARTICLE 11 - PROTECTION OF WORK, PROPERTY AND THE PUBLIC

- a. The contractors shall be jointly responsible for the entire site and the building or construction of the same and provide all the necessary protections, as required by the owner or designer, and by laws or ordinances governing such conditions. They shall be responsible for any damage to the owner's property, or of that of others on the job, by them, their personnel, or their subcontractors, and shall make good such damages. They shall be responsible for and pay for any damages caused to the owner. All contractors shall have access to the project at all times.
- b. The contractor shall provide cover and protect all portions of the structure when the work is not in progress, provide and set all temporary roofs, covers for doorways, sash and windows, and all other materials necessary to protect all the work on the building, whether set by him, or any of the subcontractors. Any work damaged through the lack of proper protection or from any other cause, shall be repaired or replaced without extra cost to the owner.
- c. No fires of any kind will be allowed inside or around the operations during the course of construction without special permission from the designer and owner.
- d. The contractor shall protect all trees and shrubs designated to remain in the vicinity of the operations by building substantial boxes around same. He shall barricade all walks, roads, etc., as directed by the designer to keep the public away from the construction. All trenches, excavations or other hazards in the vicinity of the work shall be well barricaded and properly lighted at night.
- e. The contractor shall provide all necessary safety measures for the protection of all persons on the job, including the requirements of the A.G.C. *Accident Prevention Manual in Construction*, as amended, and shall fully comply with all state laws or regulations and North Carolina State Building Code requirements to prevent accident or injury to persons on or about the location of the work. He shall clearly mark or post signs warning of hazards existing, and shall barricade excavations, elevator shafts, stairwells and similar hazards. He shall protect against damage or injury resulting from falling materials and he shall maintain all protective devices and signs throughout the progress of the work.
- f. The contractor shall adhere to the rules, regulations and interpretations of the North Carolina Department of Labor relating to Occupational Safety and Health Standards for the Construction Industry (Title 29, Code of Federal Regulations, Part 1926, published in Volume 39, Number 122, Part II, June 24, 1974, *Federal Register*), and revisions thereto as adopted by General Statutes of North Carolina 95-126 through 155.
- g. The contractor shall designate a responsible person of his organization as safety officer/inspector to inspect the project site for unsafe health and safety hazards, to report these hazards to the contractor for correction, and whose duties also include accident prevention on the project, and to provide other safety and health measures on the project site as required by the terms and conditions of the contract. The name of the safety inspector shall be made known to the designer and owner at the time of the preconstruction conference and in all cases prior to any work starting on the project.
- h. In the event of emergency affecting the safety of life, the protection of work, or the safety of adjoining properties, the contractor is hereby authorized to act at his own discretion, without further authorization from anyone, to prevent such threatened injury or damage.

Any compensation claimed by the contractor on account of such action shall be determined as provided for under Article 19(b).

- i. Any and all costs associated with correcting damage caused to adjacent properties of the construction site or staging area shall be borne by the contractor. These costs shall include but not be limited to flooding, mud, sand, stone, debris, and discharging of waste products.

## **ARTICLE 12 - SEDIMENTATION POLLUTION CONTROL ACT OF 1973**

- a. Any land-disturbing activity performed by the contractor(s) in connection with the project shall comply with all erosion control measures set forth in the contract documents and any additional measures which may be required in order to ensure that the project is in full compliance with the Sedimentation Pollution Control Act of 1973, as implemented by Title 15, North Carolina Administrative Code, Chapter 4, Sedimentation Control, Subchapters 4A, 4B and 4C, as amended (15 N.C.A.C. 4A, 4B and 4C).
- b. Upon receipt of notice that a land-disturbing activity is in violation of said act, the contractor(s) shall be responsible for ensuring that all steps or actions necessary to bring the project in compliance with said act are promptly taken.
- c. The contractor(s) shall be responsible for defending any legal actions instituted pursuant to N.C.G.S. 113A-64 against any party or persons described in this article.
- d. To the fullest extent permitted by law, the contractor(s) shall indemnify and hold harmless the owner, the designer and the agents, consultants and employees of the owner and designer, from and against all claims, damages, civil penalties, losses and expenses, including, but not limited to, attorneys' fees, arising out of or resulting from the performance of work or failure of performance of work, provided that any such claim, damage, civil penalty, loss or expense is attributable to a violation of the Sedimentation Pollution Control Act. Such obligation shall not be construed to negate, abridge or otherwise reduced any other right or obligation of indemnity which would otherwise exist as to any party or persons described in this article.

## **ARTICLE 13 - INSPECTION OF THE WORK**

- a. It is a condition of this contract that the work shall be subject to inspection during normal working hours and during any time work is in preparation and progress by the designer, designated official representatives of the owner, State Construction Office and those persons required by state law to test special work for official approval. The contractor shall therefore provide safe access to the work at all times for such inspections.
- b. All instructions to the contractor will be made only by or through the designer or his designated project representative. Observations made by official representatives of the owner shall be conveyed to the designer for review and coordination prior to issuance to the contractor.
- c. All work shall be inspected by designer, special inspector and/or State Construction Office prior to being covered by the contractor. Contractor shall give a minimum two weeks notice unless otherwise agreed to by all parties. If inspection fails, after the first reinspection all costs associated with additional reinspections shall be borne by the contractor.

- d. Where special inspection or testing is required by virtue of any state laws, instructions of the designer, specifications or codes, the contractor shall give adequate notice to the designer of the time set for such inspection or test, if the inspection or test will be conducted by a party other than the designer. Such special tests or inspections will be made in the presence of the designer, or his authorized representative, and it shall be the contractor's responsibility to serve ample notice of such tests.
- e. All laboratory tests shall be paid by the owner unless provided otherwise in the contract documents except the general contractor shall pay for laboratory tests to establish design mix for concrete, and for additional tests to prove compliance with contract documents where materials have tested deficient except when the testing laboratory did not follow the appropriate ASTM testing procedures.
- f. Should any work be covered up or concealed prior to inspection and approval by the designer, special inspector, and/or State Construction Office such work shall be uncovered or exposed for inspection, if so requested by the designer in writing. Inspection of the work will be made upon notice from the contractor. All cost involved in uncovering, repairing, replacing, recovering and restoring to design condition, the work that has been covered or concealed will be paid by the contractor involved.

#### **ARTICLE 14 - CONSTRUCTION SUPERVISION AND SCHEDULE**

- a. Throughout the progress of the work, each contractor shall keep at the job site, a competent superintendent and supervisory staff satisfactory to the designer and the owner. The superintendent and supervisory staff shall not be changed without the consent of the designer and owner unless said superintendent ceases to be employed by the contractor or ceases to be competent as determined by the contractor, designer or owner. The superintendent and other staff designated by the contractor in writing shall have authority to act on behalf of the contractor, and instructions, directions or notices given to him shall be as binding as if given to the contractor. However, directions, instructions, and notices shall be confirmed in writing.
- b. The contractor shall examine and study the drawings and specifications and fully understand the project design, and shall provide constant and efficient supervision to the work. Should he discover any discrepancies of any sort in the drawings or specifications, he shall report them to the designer without delay. He will not be held responsible for discrepancies in the drawings and/or specifications, but shall be held responsible to report them should they become known to him.
- c. All contractors shall be required to cooperate and consult with each other during the construction of this project. Prior to installation of work, all contractors shall jointly prepare coordination drawings, showing locations of various ductworks, piping, motors, pumps, and other mechanical or electrical equipment, in relation to the structure, walls and ceilings. These drawings shall be submitted to the designer through the Project Expediter for information only. Each contractor shall lay out and execute his work to cause the least delay to other contractors. Each contractor shall be financially responsible for any damage to other contractor's work and for undue delay caused to other contractors on the project.
- d. The contractor is required to attend job site progress conferences as called by the designer. The contractor shall be represented at these job progress conferences by both home office and project personnel. These representatives shall have authority to act on behalf of the contractor. These meetings shall be open to subcontractors, material

suppliers and any others who can contribute toward maintaining required job progress. It shall be the principal purpose of these meetings, or conferences, to effect coordination, cooperation and assistance in every practical way toward the end of maintaining progress of the project on schedule and to complete the project within the specified contract time. Each contractor shall be prepared to assess progress of the work as required in his particular contract and to recommend remedial measures for correction of progress as may be appropriate. The designer or his authorized representative shall be the coordinator of the conferences and shall preside as chairman. The contractor shall turn over a copy of his daily reports to the Designer and Owner at the job site progress conference. Owner will determine daily report format.

- e. The contractor(s) shall, employ an engineer or a land surveyor licensed in the State of North Carolina to lay out the work and to establish a bench mark in a location where same will not be disturbed and where direct instruments sights may be taken.
- f. The designer shall designate a Project Expediter on projects involving two or more prime contracts. The Project Expediter shall be designated in the Supplementary General Conditions. The Project Expediter shall have at a minimum the following responsibilities.
  - 1. Prepare the project construction schedule and shall allow all prime contractors (multi-prime contract) and subcontractors (single-prime contract) performing general, plumbing, HVAC, and electrical work equal input into the preparation of the initial construction schedule.
  - 2. Maintain a project progress schedule for all contractors.
  - 3. Give adequate notice to all contractors to ensure efficient continuity of all phases of the work.
  - 4. Notify the designer of any changes in the project schedule.
  - 5. Recommend to the owner whether payment to a contractor shall be approved.
- g. It shall be the responsibility of the Project Expediter to cooperate with and obtain from several prime contractors and subcontractors on the job, their respective work activities and integrate these activities into a project construction schedule in form of a detailed bar chart or Critical Path Method (CPM), schedule. Each prime contractor shall provide work activities within fourteen (14) days of request by the Project Expediter. A “work activity”, for scheduling purposes, shall be any component or contractual requirement of the project requiring at least one (1) day, but not more than fourteen (14) days, to complete or fulfill. The project construction schedule shall graphically show all salient features of the work required to construct the project from start to finish and within the allotted time established in the contract. The time (in days) between the contractor’s early completion and contractual completion dates is part of the project total float time; and shall be used as such, unless amended by a change order. On a multi-prime project, each prime contractor shall review the proposed construction schedule and approve same in writing. The Project Expediter shall submit the proposed construction schedule to the designer for comments. The complete Project construction schedule shall be of the type set forth in the Supplementary General Condition or subparagraph (1) or (2) below, as appropriate:

1. For a project with total contracts of \$500,000 or less, a bar chart schedule will satisfy the above requirement. The schedule shall indicate the estimated starting and completion dates for each major element of the work.
2. For a project with total contracts over \$500,000, a Critical Path Method (CPM) schedule shall be utilized to control the planning and scheduling of the Work. The CPM schedule shall be the responsibility of the Project Expediter and shall be paid for by the Project Expediter.

**Bar Chart Schedule:** Where a bar chart schedule is required, 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, including but not limited to the placing of orders for materials, submission of shop drawings and other Submittals for approval, approval of shop drawings by designers, 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. The Contractor shall allow sufficient time in his schedule for all commissioning, required inspections and completion of final punchlist(s). Each Work activity will be assigned a time estimate by the Contractor. One day shall be the smallest time unit used.

**CPM Schedule:** Where a CPM schedule is required, it shall be in time-scaled precedence format using the Project Expediter's logic and time estimates. The CPM schedule shall be drawn or plotted with activities grouped or zoned by Work area or subcontract as opposed to a random (or scattered) format. The CPM 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 of the work to be performed by the Contractor. The Contractor shall allow sufficient time in his schedule for all commissioning, required inspections and completion of final punchlist(s).. Each Work activity will be assigned a time estimate by the Contractor. One day shall be the smallest time unit used.

The CPM 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, and clearly highlight all activities on the critical path. "Total float" and "free float" shall be indicated for all activities. Float time 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 within the Contract time. Extensions to the Contract time, when granted by Change Order, will be granted only when equitable time adjustment exceeds the Total Float in the activity or path of activities affected by the change. On contracts with a price over \$2,500,000, the CPM schedule shall also show what part of the Contract Price is attributable to each activity on the schedule, the sum of which for all activities shall equal the total Contract Price.

**Early Completion of Project:** The Contractor may attempt to complete the project prior to 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 liquidated damages to the Owner because of its failure to complete by its planned earlier date. Likewise, the Owner shall not pay the Contractor any additional compensation for early completion nor will the Owner owe the Contractor any compensation should the Owner, its officers, employees, or agents cause the Contractor not to complete earlier than the date required by the Contract Documents.

- h. The proposed project construction schedule shall be presented to the designer no later than fifteen (15) days after written notice to proceed. No application for payment will be processed until this schedule is accepted by the designer and owner.
- i. The approved project construction schedule shall be distributed to all contractors and displayed at the job site by the Project Expediter.
- j. The several contractors shall be responsible for their work activities and shall notify the Project Expediter of any necessary changes or adjustments to their work. The Project Expediter shall maintain the project construction schedule, making biweekly adjustments, updates, corrections, etc., that are necessary to finish the project within the Contract time, keeping all contractors and the designer fully informed. Copy of a bar chart schedule annotated to show the current progress shall be submitted by the Contractor(s) to the designer, along with monthly request for payment. For project requiring CPM schedule, the Contractor shall submit a biweekly report of the status of all activities. The bar chart schedule or status report shall show the actual Work completed to date in comparison with the original Work scheduled for all activities. If any activities of the work of several contractors are behind schedule, the contractor must indicate in writing, what measures will be taken to bring each such activity back on schedule and to ensure that the Contract Completion Date is not exceeded. A plan of action and recovery schedule shall be developed and submitted to the designer by the Project Expediter, when (1) the contractor's report indicates delays, that are in the opinion of the designer or the owner, of sufficient magnitude that the contractor's ability to complete the work by the scheduled completion is brought into question; (2) the updated construction schedule is thirty (30) days behind the planned or baseline schedule and no legitimate time extensions, as determined by the Designer, are in process; and (3) the contractor desires to make changes in the logic (sequencing of work) or the planned duration of future activities of the CPM schedule which, in the opinion of the designer or the owner, are of a major nature. The plan of action, when required shall be submitted to the Owner for review within two (2) business days of the Contractor receiving the Owner's written demand. The recovery schedule, when required, shall be submitted to the Owner within five (5) calendar days of the Contractor's receiving the Owner's written demand. Failure to provide an updated construction schedule or a recovery schedule may be grounds for rejection of payment applications or withholding of funds as set forth in Article 33.
- k. The Project Expediter shall notify each contractor of such events or time frames that are critical to the progress of the job. Such notice shall be timely and reasonable. Should the progress be delayed due to the work of any of the several contractors, it shall be the duty of the Project Expediter to immediately notify the contractor(s) responsible for such delay, the designer, the State Construction Office and other prime contractors. The designer shall determine the contractor(s) who caused the delays and notify the bonding company of the responsible contractor(s) of the delays; and shall make a recommendation to the owner regarding further action.
- l. Designation as Project Expediter entails an additional project control responsibility and does not alter in any way the responsibility of the contractor so designated, nor the

responsibility of the other contractors involved in the project. The project expeditor's Superintendent(s) shall be in attendance at the Project site at all times when work is in progress unless conditions are beyond the control of the Contractor or until termination of the Contract in accordance with the Contract Documents. It is understood that such Superintendent shall be acceptable to the Owner and Designer and shall be the one who will be continued in that capacity for the duration of the project unless he ceases to be on the Contractor's payroll or the Owner otherwise agrees. The Superintendent shall not be employed on any other project for or by the Contractor or by any other entity during the course of the Work. If the Superintendent is employed by the Contractor on another project without the Owner's approval, then the Owner may deduct from the Contractor's monthly general condition costs and amount representing the Superintendent's cost and shall deduct that amount for each month thereafter until the Contractor has the Superintendent back on the Owner's Project full-time.

#### **ARTICLE 15 - SEPARATE CONTRACTS AND CONTRACTOR RELATIONSHIPS**

- a. Effective from January 1, 2002, Chapter 143, Article 8, was amended, to allow public contracts to be delivered by the following delivery methods: single-prime, dual (single-prime and separate-prime), construction manager at risk, and alternative contracting method as approved by the State Building Commission. The owner reserves the right to prepare separate specifications, receive separate bids, and award separate contracts for such other major items of work as may be in the best interest of the State. For the purposes of a single prime contract, refer to Article 1 – Definitions.
- b. All contractors shall cooperate with each other in the execution of their work, and shall plan their work in such manner as to avoid conflicting schedules or delay of the work. See Article 14, Construction Supervision.
- c. If any part of contractor's work depends upon the work of another contractor, defects which may affect that work shall be reported to the designer in order that prompt inspection may be made and the defects corrected. Commencement of work by a contractor where such condition exists will constitute acceptance of the other contractor's work as being satisfactory in all respects to receive the work commenced, except as to defects which may later develop. The designer shall be the judge as to the quality of work and shall settle all disputes on the matter between contractors.
- d. Any mechanical or electrical work such as sleeves, inserts, chases, openings, penetrations, etc., which is located in the work of the general contractor shall be built in by the general contractor. The respective mechanical and electrical contractors shall set all sleeves, inserts and other devices that are to be incorporated into the structure in cooperation and under the supervision of the general contractor. The responsibility for the exact location of such items shall be that of the mechanical and/or electrical contractor.
- e. The designer and the owner shall have access to the work whenever it is in preparation and progress and during normal working hours. The contractor shall provide facilities for such access so the designer may perform his functions under the contract documents.
- f. Should a contractor cause damage to the work or property of another contractor, he shall be directly responsible, and upon notice, shall promptly settle the claim or otherwise resolve the dispute.

#### **ARTICLE 16 - SUBCONTRACTS AND SUBCONTRACTORS**

- a. Within thirty (30) days after award of the contract, the contractor shall submit to the designer, owner and to the State Construction Office a list giving the names and addresses of subcontractors and equipment and material suppliers he proposes to use, together with the scope of their respective parts of the work. Should any subcontractor be disapproved by the designer or owner, the designer or owner shall submit his reasons for disapproval in writing to the State Construction Office for its consideration with a copy to the contractor. If the State Construction Office concurs with the designer's or owner's recommendation, the contractor shall submit a substitute for approval. The designer and owner shall act promptly in the approval of subcontractors, and when approval of the list is given, no changes of subcontractors will be permitted except for cause or reason considered justifiable by the designer or owner.
- b. The designer will furnish to any subcontractor, upon request, evidence regarding amounts of money paid to the contractor on account of the subcontractor's work.
- c. The contractor is and remains fully responsible for his own acts or omissions as well as those of any subcontractor or of any employee of either. The contractor agrees that no contractual relationship exists between the subcontractor and the owner in regard to the contract, and that the subcontractor acts on this work as an agent or employee of the contractor.
- d. The owner reserves the right to limit the amount of portions of work to be subcontracted as hereinafter specified.

## **ARTICLE 17 - CONTRACTOR AND SUBCONTRACTOR RELATIONSHIPS**

The contractor agrees that the terms of these contract documents shall apply equally to each subcontractor as to the contractor, and the contractor agrees to take such action as may be necessary to bind each subcontractor to these terms. The contractor further agrees to conform to the Code of Ethical Conduct as adopted by the Associated General Contractors of America, Inc., with respect to contractor-subcontractor relationships, and that payments to subcontractors shall be made in accordance with the provisions of G.S. 143-134.1 titled Interest on final payments due to prime contractors: payments to subcontractors.

- a. On all public construction contracts which are let by a board or governing body of the state government or any political subdivision thereof, except contracts let by the Department of Transportation pursuant to G.S. 136-28.1, the balance due prime contractors shall be paid in full within 45 days after respective prime contracts of the project have been accepted by the owner, certified by the architect, engineer or designer to be completed in accordance with terms of the plans and specifications, or occupied by the owner and used for the purpose for which the project was constructed, whichever occurs first. Provided, however, that whenever the architect or consulting engineer in charge of the project determines that delay in completion of the project in accordance with terms of the plans and specifications is the fault of the contractor, the project may be occupied and used for the purposes for which it was constructed without payment of any interest on amounts withheld past the 45 day limit. No payment shall be delayed because of the failure of another prime contractor on such project to complete his contract. Should final payment to any prime contractor beyond the date such contracts have been certified to be completed by the designer or architect, accepted by the owner, or occupied by the owner and used for the purposes for which the project was constructed, be delayed by more than 45 days, said prime contractor shall be paid interest, beginning on the 46th day, at the rate of one percent (1%) per month or fraction thereof unless a lower rate is



agreed upon on such unpaid balance as may be due. In addition to the above final payment provisions, periodic payments due a prime contractor during construction shall be paid in accordance with the payment provisions of the contract documents or said prime contractor shall be paid interest on any such unpaid amount at the rate stipulated above for delayed final payments. Such interest shall begin on the date the payment is due and continue until the date on which payment is made. Such due date may be established by the terms of the contract. Funds for payment of such interest on state-owned projects shall be obtained from the current budget of the owning department, institution or agency. Where a conditional acceptance of a contract exists, and where the owner is retaining a reasonable sum pending correction of such conditions, interest on such reasonable sum shall not apply.

- b. Within seven days of receipt by the prime contractor of each periodic or final payment, the prime contractor shall pay the subcontractor based on work completed or service provided under the subcontract. Should any periodic or final payment to the subcontractor be delayed by more than seven days after receipt of periodic or final payment by the prime contractor, the prime contractor shall pay the subcontractor interest, beginning on the eighth day, at the rate of one percent (1%) per month or fraction thereof on such unpaid balance as may be due.
- c. The percentage of retainage on payments made by the prime contractor to the subcontractor shall not exceed the percentage of retainage on payments made by the owner to the prime contractor. Any percentage of retainage on payments made by the prime contractor to the subcontractor that exceeds the percentage of retainage on payments made by the owner to the prime contractor shall be subject to interest to be paid by the prime contractor to the subcontractor at the rate of one percent (1%) per month or fraction thereof.
- d. Nothing in this section shall prevent the prime contractor at the time of application and certification to the owner from withholding application and certification to the owner for payment to the subcontractor for unsatisfactory job progress; defective construction not remedied; disputed work; third-party claims filed or reasonable evidence that claim will be filed; failure of subcontractor to make timely payments for labor, equipment and materials; damage to prime contractor or another subcontractor; reasonable evidence that subcontract cannot be completed for the unpaid balance of the subcontract sum; or a reasonable amount for retainage not to exceed the initial percentage retained by owner.

## **ARTICLE 18 - DESIGNER'S STATUS**

- a. The designer shall provide general administration of the performance of construction contracts, including liaison and necessary inspection of the work to ensure compliance with plans and specifications. He is the agent of the owner only for the purpose of constructing this work and to the extent stipulated in the contract documents. He has authority to direct work to be performed, to stop work, to order work removed, or to order corrections of faulty work, where any such action by the designer may be necessary to assure successful completion of the work.
- b. The designer is the impartial interpreter of the contract documents, and, as such, he shall exercise his powers under the contract to enforce faithful performance by both the owner and the contractor, taking sides with neither.
- c. Should the designer cease to be employed on the work for any reason whatsoever, then the owner shall employ a competent replacement who shall assume the status of the former designer.

- d. The designer and his consultants will make inspections of the project. He will inspect the progress, the quality and the quantity of the work.
- e. The designer and the owner shall have access to the work whenever it is in preparation and progress during normal working hours. The contractor shall provide facilities for such access so the designer and owner may perform their functions under the contract documents.
- f. Based on the designer's inspections and evaluations of the project, the designer shall issue interpretations, directives and decisions as may be necessary to administer the project. His decisions relating to artistic effect and technical matters shall be final, provided such decisions are within the limitations of the contract.

## **ARTICLE 19 - CHANGES IN THE WORK**

- a. The owner may have changes made in the work covered by the contract. These changes will not invalidate and will not relieve or release the contractor from any guarantee given by him pertinent to the contract provisions. These changes will not affect the validity of the guarantee bond and will not relieve the surety or sureties of said bond. All extra work shall be executed under conditions of the original contract.
- b. Except in an emergency endangering life or property, no change shall be made by the contractor except upon receipt of approved change order or written field order from the designer, countersigned by the owner and the state construction office authorizing such change. No claim for adjustments of the contract price shall be valid unless this procedure is followed.

A field order, transmitted by fax, electronically, or hand delivered, may be used where the change involved impacts the critical path of the work. A formal change order shall be issued as expeditiously as possible.

In the event of emergency endangering life or property, the contractor may be directed to proceed on a time and material basis whereupon the contractor shall proceed and keep accurately on such form as specified by the designer or owner, a correct account of costs together with all proper invoices, payrolls and supporting data. Upon completion of the work the change order will be prepared as outlined under either Method "c(1)" or Method "c(2)" or both.

- c. In determining the values of changes, either additive or deductive, contractors are restricted to the use of the following methods:
  - 1. Where the extra work involved is covered by unit prices quoted in the proposal, or subsequently agreed to by the Contractor, Designer, Owner and State Construction Office the value of the change shall be computed by application of unit prices based on quantities, estimated or actual as agreed of the items involved, except in such cases where a quantity exceeds the estimated quantity allowance in the contract by one hundred percent (100%) or more. In such cases, either party may elect to proceed under subparagraph c2 herein. If neither party elects to proceed under c2, then unit prices shall apply.
  - 2. The contracting parties shall negotiate and agree upon the equitable value of the change prior to issuance of the change order, and the change order shall stipulate the corresponding lump sum adjustment to the contract price.

- d. Under Paragraph "b" and Methods "c(2)" above, the allowances for overhead and profit combined shall be as follows: all contractors (the single contracting entity (prime), his subcontractors(1<sup>st</sup> tier subs), or their sub-subcontractors (2<sup>nd</sup> tier subs, 3<sup>rd</sup> tier subs, etc)) shall be allowed a maximum of 10% on work they each self-perform; the prime contractor shall be allowed a maximum of 5% on contracted work of his 1<sup>st</sup> tier sub; 1<sup>st</sup> tier, 2<sup>nd</sup> tier, 3<sup>rd</sup> tier, etc contractors shall be allowed a maximum of 2.5% on the contracted work of their subs. ; Under Method "c(1)", no additional allowances shall be made for overhead and profit. In the case of deductible change orders, under Method "c(2)" and Paragraph (b) above, the contractor shall include no less than five percent (5%) profit, but no allowances for overhead.
- e. The term "net cost" as used herein shall mean the difference between all proper cost additions and deductions. The "cost" as used herein shall be limited to the following:
1. The actual costs of materials and supplies incorporated or consumed as part of the work;
  2. The actual costs of labor expended on the project site; labor expended in coordination, change order negotiation, record document maintenance, shop drawing revision or other tasks necessary to the administration of the project are considered overhead whether they take place in an office or on the project site.
  3. The actual costs of labor burden, limited to the costs of social security (FICA) and Medicare/Medicaid taxes; unemployment insurance costs; health/dental/vision insurance premiums; paid employee leave for holidays, vacation, sick leave, and/or petty leave, not to exceed a total of 30 days per year; retirement contributions; worker's compensation insurance premiums; and the costs of general liability insurance when premiums are computed based on payroll amounts; the total of which shall not exceed thirty percent (30%) of the actual costs of labor;
  4. The actual costs of rental for tools, excluding hand tools; equipment; machinery; and temporary facilities required for the work;
  5. The actual costs of premiums for bonds, insurance, permit fees, and sales or use taxes related to the work.

Overtime and extra pay for holidays and weekends may be a cost item only to the extent approved by the owner.

- f. Should concealed conditions be encountered in the performance of the work below grade, or should concealed or unknown conditions in an existing structure be at variance with the conditions indicated by the contract documents, the contract sum and time for completion may be equitably adjusted by change order upon claim by either party made within thirty (30) days after the condition has been identified. The cost of such change shall be arrived at by one of the foregoing methods. All change orders shall be supported by a unit cost breakdown showing method of arriving at net cost as defined above.
- g. In all change orders, the procedure will be for the designer to request proposals for the change order work in writing. The contractor will provide such proposal and supporting data in suitable format. The designer shall verify correctness. Delay in the processing of the change order due to lack of proper submittal by the contractor of all required supporting data shall not constitute grounds for a time extension or basis of a claim. Within fourteen (14) days after receipt of the contractor's accepted proposal including all supporting documentation required by the designer, the designer shall prepare the change order and forward to the contractor for his signature or otherwise respond, in writing, to

the contractor's proposal. Within seven (7) days after receipt of the change order executed by the contractor, the designer shall, certify the change order by his signature, and forward the change order and all supporting data to the owner for the owner's signature. The owner shall execute the change order and forward to the State Construction Office for final approval, within seven (7) days of receipt. The State Construction Office shall act on the change order within seven (7) days. In case of emergency or extenuating circumstances, approval of changes may be obtained verbally by telephone or field orders approved by all parties, then shall be substantiated in writing as outlined under normal procedure.

- h. At the time of signing a change order, the contractor shall be required to certify as follows:

"I certify that my bonding company will be notified forthwith that my contract has been changed by the amount of this change order, and that a copy of the approved change order will be mailed upon receipt by me to my surety."

- i. A change order, when issued, shall be full compensation, or credit, for the work included, omitted or substituted. It shall show on its face the adjustment in time for completion of the project as a result of the change in the work.
- j. If, during the progress of the work, the owner requests a change order and the contractor's terms are unacceptable, the owner, with the approval of the State Construction Office, may require the contractor to perform such work on a time and material basis whereupon the contractor shall proceed and keep accurately on such form as specified by the Designer or owner, a correct account of cost together with all proper invoices, payrolls and supporting data. Upon completion of the work a change order will be prepared with allowances for overhead and profit per paragraph d. above and "net cost" and "cost" per paragraph e. above. Without prejudice, nothing in this paragraph shall preclude the owner from performing or to have performed that portion of the work requested in the change order.

## **ARTICLE 20 - CLAIMS FOR EXTRA COST**

- a. Should the contractor consider that as a result of instructions given by the designer, he is entitled to extra cost above that stated in the contract, he shall give written notice thereof to the designer within seven (7) days without delay. The written notice shall clearly state that a claim for extra cost is being made and shall provide a detailed justification for the extra cost. The contractor shall not proceed with the work affected until further advised, except in emergency involving the safety of life or property, which condition is covered in Article 19(b) and Article 11(h). No claims for extra compensation shall be considered unless the claim is so made. The designer shall render a written decision within seven (7) days of receipt of claim.
- b. The contractor shall not act on instructions received by him from persons other than the designer, and any claims for extra compensation or extension of time on account of such instruction will not be honored. The designer shall not be responsible for misunderstandings claimed by the contractor of verbal instructions which have not been confirmed in writing, and in no case shall instructions be interpreted as permitting a departure from the contract documents unless such instruction is confirmed in writing and supported by a properly authorized change order.
- c. Should a claim for extra compensation that complies with the requirements of (a) above by the contractor and is denied by the designer or owner, and cannot be resolved by a

representative of the State Construction Office, the contractor may request a mediation in connection with GS 143-128(f1) in the dispute resolution rules adopted by the State Building Commission (1 N.C.A.C. 30H .0101 through .1001). If the contractor is unable to resolve its claim as a result of mediation, the contractor may pursue the claim in accordance with the provisions of G.S. 143-135.3, or G.S. 143-135.6 where Community Colleges are the owner, and the following:

1. A contractor who has not completed a contract with a board for construction or repair work and who has not received the amount he claims is due under the contract may submit a verified written claim to the director of the State Construction Office of the Department of Administration for the amount the contractor claims is due. The director may deny, allow or compromise the claim, in whole or in part. A claim under this subsection is not a contested case under Chapter 150B of the General Statutes.
2. (a) A contractor who has completed a contract with a board for construction or repair work and who has not received the amount he claims is due under the contract may submit a verified written claim to the director of the State Construction Office of the Department of Administration for the amount the contractor claims is due. The claim shall be submitted within sixty (60) days after the contractor receives a final statement of the board's disposition of his claim and shall state the factual basis for the claim.
  - (b) The director shall investigate a submitted claim within ninety (90) days of receiving the claim, or within any longer time period upon which the director and the contractor agree. The contractor may appear before the director, either in person or through counsel, to present facts and arguments in support of his claim. The director may allow, deny or compromise the claim, in whole or in part. The director shall give the contractor a written statement of the director's decision on the contractor's claim.
  - (c) A contractor who is dissatisfied with the director's decision on a claim submitted under this subsection may commence a contested case on the claim under Chapter 150B of the General Statutes. The contested case shall be commenced within sixty (60) days of receiving the director's written statement of the decision.
  - (d) As to any portion of a claim that is denied by the director, the contractor may, in lieu of the procedures set forth in the preceding subsection of this section, within six (6) months of receipt of the director's final decision, institute a civil action for the sum he claims to be entitled to under the contract by filing a verified complaint and the issuance of a summons in the Superior Court of Wake County or in the superior court of any county where the work under the contract was performed. The procedure shall be the same as in all civil actions except that all issues shall be tried by the judge, without a jury.

## **ARTICLE 21 - MINOR CHANGES IN THE WORK**

The designer will have the authority to order minor changes in the work not involving an adjustment in the contract sum or time for completion, and not inconsistent with the intent of the contract documents. Such changes shall be effected by written order, copied to the State Construction Office, and shall be binding on the owner and the contractor.

## **ARTICLE 22 - UNCORRECTED FAULTY WORK**

Should the correction of faulty or damaged work be considered inadvisable or inexpedient by the owner and the designer, the owner shall be reimbursed by the contractor. A change order will be issued to reflect a reduction in the contract sum.

#### **ARTICLE 23 - TIME OF COMPLETION, DELAYS, EXTENSION OF TIME**

- a. The time of completion is stated in the Supplementary General Conditions and in the Form of Construction Contract. The Project Expediter, upon notice of award of contract, shall prepare a construction schedule to complete the project within the time of completion as required by Article 14.
- b. The contractors shall commence work to be performed under this agreement on a date to be specified in a written Notice to Proceed from the designer and shall fully complete all work hereunder within the time of completion stated. Time is of the essence and the contractor acknowledges the Owner will likely suffer financial damage for failure to complete the work within the time of completion. For each day in excess of the above number of days, the contractor(s) shall pay the owner the sum stated as liquidated damages reasonably estimated in advance to cover the losses to be incurred by the owner by reason of failure of said contractor(s) to complete the work within the time specified, such time being in the essence of this contract and a material consideration thereof.
- c. In the event of multiple prime contractors, the designer shall be the judge as to the division of responsibility between the contractor(s), based on the construction schedule, weekly reports and job records, and shall apportion the amount of liquidated damages to be paid by each of them, according to delay caused by any or all of them.
- d. If the contractor is delayed at any time in the progress of his work solely by any act or negligence of the owner, the designer, or by any employee of either; by any separate contractor employed by the owner; by changes ordered in the work; by labor disputes at the project site; by abnormal weather conditions not reasonably anticipated for the locality where the work is performed; by unavoidable casualties; by any causes beyond the contractor's control; or by any other causes which the designer and owner determine may justify the delay, then the contract time may be extended by change order only for the time which the designer and owner may determine is reasonable.

Time extensions will not be granted for rain, wind, snow or other natural phenomena of normal intensity for the locality where work is performed. For purpose of determining extent of delay attributable to unusual weather phenomena, a determination shall be made by comparing the weather for the contract period involved with the average of the preceding five (5) year climatic range during the same time interval based on the National Oceanic and Atmospheric Administration National Weather Service statistics for the locality where work is performed and on daily weather logs kept on the job site by the contractor reflecting the effect of the weather on progress of the work and initialed by the designer's representative. No weather delays shall be considered after the building is dried in unless work claimed to be delayed is on the critical path of the baseline schedule or approved updated schedule. Time extensions for weather delays, acts of God, labor disputes, fire, delays in transportation, unavoidable casualties or other delays which are beyond the control of the Owner do not entitle the Contractor to compensable damages for delays. Any contractor claim for compensable damages for delays is limited to delays caused solely by the owner or its agents. Contractor caused delays shall be accounted for before owner or designer caused delays in the case of concurrent delays.

- e. Request for extension of time shall be made in writing to the designer, copies to the owner and SCO, within twenty (20) days following cause of delay. In case of continuing cause for delay, the Contractor shall notify the Designer to the designer, copies to the owner and SCO, of the delay within 20 days of the beginning of the delay and only one claim is necessary.
- f. The contractor shall notify his surety in writing of extension of time granted.
- g. No claim for time extension shall be allowed on account of failure of the designer to furnish drawings or instructions until twenty (20) days after demand for such drawings and/or instructions. See Article 5c. Demand must be in written form clearly stating the potential for delay unless the drawings or instructions are provided. Any delay granted will begin after the twenty (20) day demand period is concluded.

#### **ARTICLE 24 - PARTIAL UTILIZATION/BENEFICIAL OCCUPANCY**

- a. The owner may desire to occupy or utilize all or a portion of the project prior to the completion of the project.
- b. Should the owner request a utilization of a building or portion thereof, the designer shall perform a designer final inspection of area after being notified by the contractor that the area is ready for such. After the contractor has completed designer final inspection punch list and the designer has verified, then the designer shall schedule a beneficial occupancy inspection at a time and date acceptable to the owner, contractor(s) and State Construction Office. If beneficial occupancy is granted by the State Construction Office, in such areas the following will be established:
  - 1. The beginning of guarantees and warranties period for the equipment necessary to support. in the area.
  - 2. The owner assumes all responsibilities for utility costs for entire building.
  - 2. Contractor will obtain consent of surety.
  - 3. Contractor will obtain endorsement from insurance company permitting beneficial occupancy.
- c. The owner shall have the right to exclude the contractor from any part of the project which the designer has so certified to be substantially complete, but the owner will allow the contractor reasonable access to complete or correct work to bring it into compliance with the contract.
- d. Occupancy by the owner under this article will in no way relieve the contractor from his contractual requirement to complete the project within the specified time. The contractor will not be relieved of liquidated damages because of beneficial occupancy. The designer may prorate liquidated damages based on the percentage of project occupied.

#### **ARTICLE 25 - FINAL INSPECTION, ACCEPTANCE, AND PROJECT CLOSEOUT**

- a. Upon notification from the contractor(s) that the project is complete and ready for inspection, the designer shall make a Designer final inspection to verify that the project is complete and ready for SCO final inspection. Prior to SCO final inspection, the contractor(s) shall complete all items requiring corrective measures noted at the Designer

final inspection. The designer shall schedule a SCO final inspection at a time and date acceptable to the owner, contractor(s) and State Construction Office.

- b. At the SCO final inspection, the designer and his consultants shall, if job conditions warrant, record a list of items that are found to be incomplete or not in accordance with the contract documents. At the conclusion of the SCO final inspection, the designer and State Construction Office representative shall make one of the following determinations:
  - 1. That the project is completed and accepted.
  - 2. That the project will be accepted subject to the correction of the list of discrepancies (punch list). All punch list items must be completed within thirty (30) days of SCO final inspection or the owner may invoke Article 28, Owner's Right to Do Work.
  - 4. That the project is not complete and another date for a SCO final inspection will be established.
- c. Within fourteen (14) days of final acceptance per Paragraph b1 or within fourteen (14) days after completion of punch list per Paragraph b2 above, the designer shall certify the work and issue applicable certificate(s) of compliance.
- d. Any discrepancies listed or discovered after the date of SCO final inspection and acceptance under Paragraphs b1 or b2 above shall be handled in accordance with Article 42, Guarantee.
- f. The final acceptance date will establish the following:
  - 1. The beginning of guarantees and warranties period.
  - 2. The date on which the contractor's insurance coverage for public liability, property damage and builder's risk may be terminated.
  - 3. That no liquidated damages (if applicable) shall be assessed after this date.
  - 4. The termination date of utility cost to the contractor.
- g. Prior to issuance of final acceptance date, the contractor shall have his authorized representatives visit the project and give full instructions to the designated personnel regarding operating, maintenance, care, and adjustment of all equipment and special construction elements. In addition, the contractor shall provide to the owner a complete instructional video (media format acceptable to the owner) on the operation, maintenance, care and adjustment of all equipment and special construction elements.**

#### **ARTICLE 26 - CORRECTION OF WORK BEFORE FINAL PAYMENT**

- a. Any work, materials, fabricated items or other parts of the work which have been condemned or declared not in accordance with the contract by the designer shall be promptly removed from the work site by the contractor, and shall be immediately replaced by new work in accordance with the contract at no additional cost to the owner. Work or property of other contractors or the owner, damaged or destroyed by virtue of such faulty work, shall be made good at the expense of the contractor whose work is faulty.



- b. Correction of condemned work described above shall commence within twenty-four (24) hours after receipt of notice from the designer, and shall make satisfactory progress, as determined by the designer, until completed.
- c. Should the contractor fail to proceed with the required corrections, then the owner may complete the work in accordance with the provisions of Article 28.

#### **ARTICLE 27 - CORRECTION OF WORK AFTER FINAL PAYMENT**

See Article 35, Performance Bond and Payment Bond, and Article 42, Guarantee. Neither the final certificate, final payment, occupancy of the premises by the owner, nor any provision of the contract, nor any other act or instrument of the owner, nor the designer, shall relieve the contractor from responsibility for negligence, or faulty material or workmanship, or failure to comply with the drawings and specifications. Contractor shall correct or make good any defects due thereto and repair any damage resulting there from, which may appear during the guarantee period following final acceptance of the work except as stated otherwise under Article 42, Guarantee. The owner will report any defects as they may appear to the contractor and establish a time limit for completion of corrections by the contractor. The owner will be the judge as to the responsibility for correction of defects.

#### **ARTICLE 28 - OWNER'S RIGHT TO DO WORK**

If, during the progress of the work or during the period of guarantee, the contractor fails to prosecute the work properly or to perform any provision of the contract, the owner, after seven (7) days' written notice sent by certified mail, return receipt requested, to the contractor from the designer, may perform or have performed that portion of the work. The cost of the work may be deducted from any amounts due or to become due to the contractor, such action and cost of same having been first approved by the designer. Should the cost of such action of the owner exceed the amount due or to become due the contractor, then the contractor or his surety, or both, shall be liable for and shall pay to the owner the amount of said excess.

#### **ARTICLE 29 - ANNULMENT OF CONTRACT**

If the contractor fails to begin the work under the contract within the time specified, or the progress of the work is not maintained on schedule, or the work is not completed within the time above specified, or fails to perform the work with sufficient workmen and equipment or with sufficient materials to ensure the prompt completion of said work, or shall perform the work unsuitably or shall discontinue the prosecution of the work, or if the contractor shall become insolvent or be declared bankrupt or commit any act of bankruptcy or insolvency, or allow any final judgment to stand against him unsatisfied for a period of forty-eight (48) hours, or shall make an assignment for the benefit of creditors, or for any other cause whatsoever shall not carry on the work in an acceptable manner, the owner may give notice in writing, sent by certified mail, return receipt requested, to the contractor and his surety of such delay, neglect or default, specifying the same, and if the contractor within a period of seven (7) days after such notice shall not proceed in accordance therewith, then the owner shall, declare this contract in default, and, thereupon, the surety shall promptly take over the work and complete the performance of this contract in the manner and within the time frame specified. In the event the surety shall fail to take over the work to be done under this contract within seven (7) days after being so notified and notify the owner in writing, sent by certified mail, return receipt requested, that he is taking the same over and stating that he will diligently pursue and complete the same, the owner shall have full power and authority, without violating the contract, to take the prosecution of the work out of the hands of said contractor, to appropriate or use any or all contract materials and equipment on the grounds as may be suitable and acceptable and may enter into an agreement, either by public letting or negotiation, for the completion of said contract according to the terms and provisions thereof

or use such other methods as in his opinion shall be required for the completion of said contract in an acceptable manner. All costs and charges incurred by the owner, together with the costs of completing the work under contract, shall be deducted from any monies due or which may become due said contractor and surety. In case the expense so incurred by the owner shall be less than the sum which would have been payable under the contract, if it had been completed by said contractor, then the said contractor and surety shall be entitled to receive the difference, but in case such expense shall exceed the sum which would have been payable under the contract, then the contractor and the surety shall be liable and shall pay to the owner the amount of said excess.

### **ARTICLE 30 - CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE THE CONTRACT**

- a. Should the work be stopped by order of a court having jurisdiction, or by order of any other public authority for a period of three months, due to cause beyond the fault or control of the contractor, or if the owner should fail or refuse to make payment on account of a certificate issued by the designer within forty-five (45) days after receipt of same, then the contractor, after fifteen (15) days' written notice sent by certified mail, return receipt requested, to the owner and the designer, may suspend operations on the work or terminate the contract.
- b. The owner shall be liable to the contractor for the cost of all materials delivered and work performed on this contract plus 10 percent overhead and profit and shall make such payment. The designer shall be the judge as to the correctness of such payment.

### **ARTICLE 31 - REQUEST FOR PAYMENT**

- a. Not later than the fifth day of the month, the contractor shall submit to the designer a request for payment for work done during the previous month. The request shall be in the form agreed upon between the contractor and the designer, but shall show substantially the value of work done and materials delivered to the site during the period since the last payment, and shall sum up the financial status of the contract with the following information:
  1. Total of contract including change orders.
  2. Value of work completed to date.
  3. Less five percent (5%) retainage, provided however, that after fifty percent (50%) of the contractor's work has been satisfactorily completed on schedule, with approval of the owner and the State Construction Office and written consent of the surety, further requirements for retainage will be waived only so long as work continues to be completed satisfactorily and on schedule.
  4. Less previous payments.
  5. Current amount due.
- b. The contractor, upon request of the designer, shall substantiate the request with invoices of vouchers or payrolls or other evidence.
- c. Prior to submitting the first request, the contractor shall prepare for the designer a schedule showing a breakdown of the contract price into values of the various parts of the work, so arranged as to facilitate payments to subcontractors in accordance with Article 17, Contractor and Subcontractor Relationships. The contractor(s) shall list the

value of each subcontractor and supplier, identifying each minority business subcontractor and supplier as listed in Affidavit C, if applicable.

- d. When payment is made on account of stored materials and equipment, such materials must be stored on the owner's property, and the requests for payments shall be accompanied by invoices or bills of sale or other evidence to establish the owner's title to such materials and equipment. Such payments will be made only for materials that have been customized or fabricated specifically for this project. Raw materials or commodity products including but not limited to piping, conduit, CMU, metal studs and gypsum board may not be submitted. Responsibility for such stored materials and equipment shall remain with the contractor regardless of ownership title. Such stored materials and equipment shall not be removed from the owner's property. Should the space for storage on-site be limited, the contractor, at his option, shall be permitted to store such materials and/or equipment in a suitable space off-site. Should the contractor desire to include any such materials or equipment in his application for payment, they must be stored in the name of the owner in an independent, licensed, bonded warehouse approved by the designer, owner and the State Construction Office and located as close to the site as possible. The warehouse selected must be approved by the contractor's bonding and insurance companies; the material to be paid for shall be assigned to the owner and shall be inspected by the designer. Upon approval by the designer, owner and SCO of the storage facilities and materials and equipment, payment therefore will be certified. Responsibility for such stored materials and equipment shall remain with the contractor. Such stored materials and equipment shall not be moved except for transportation to the project site. Under certain conditions, the designer may approve storage of materials at the point of manufacture, which conditions shall be approved by the designer, the owner and the State Construction Office prior to approval for the storage and shall include an agreement by the storing party which unconditionally gives the State absolute right to possession of the materials at anytime. Bond, security and insurance protection shall continue to be the responsibility of the contractor(s).
- e. In the event of beneficial occupancy, retainage of funds due the contractor(s) may be reduced with the approval of the State Construction Office to an equitable amount to cover the list of items to be completed or corrected. Retainage may not be reduced to less than two and one-half (2 1/2) times the estimated value of the work to be completed or corrected. Reduction of retainage must be with the consent and approval of the contractor's bonding company.

## **ARTICLE 32 - CERTIFICATES OF PAYMENT AND FINAL PAYMENT**

- a. Within five (5) days from receipt of request for payment from the contractor, the designer shall issue and forward to the owner a certificate for payment. This certificate shall indicate the amount requested or as approved by the designer. If the certificate is not approved by the designer, he shall state in writing to the contractor and the owner his reasons for withholding payment.
- b. No certificate issued or payment made shall constitute an acceptance of the work or any part thereof. The making and acceptance of final payment shall constitute a waiver of all claims by the owner except:
  - 1. Claims arising from unsettled liens or claims against the contractor.
  - 2. Faulty work or materials appearing after final payment.
  - 3. Failure of the contractor to perform the work in accordance with drawings and specifications, such failure appearing after payment.

4. As conditioned in the performance bond and payment bond.
- c. The making and acceptance of final payment shall constitute a waiver of all claims by the contractor except those claims previously made and remaining unsettled (Article 20(c)).
- d. Prior to submitting request for final payment to the designer for approval, the contractor shall fully comply with all requirements specified in the “project closeout” section of the specifications. These requirements include but not limited to the following:
  1. Submittal of Product and Operating Manuals, Warranties and Bonds, Guarantees, Maintenance Agreements, As-Built Drawings, Certificates of Inspection or Approval from agencies having jurisdiction. (The designer must approve the Manuals prior to delivery to the owner).
  2. Transfer of Required attic stock material and all keys in an organized manner.
  3. Record of Owner’s training.
  4. Resolution of any final inspection discrepancies.
  5. Granting access to Contractor’s records, if Owner’s internal auditors have made a request for such access pursuant to Article 52.
- e. The contractor shall forward to the designer, the final application for payment along with the following documents:
  1. List of minority business subcontractors and material suppliers showing breakdown of contract amounts and total actual payments to subs and material suppliers.
  2. Affidavit of Release of Liens.
  3. Affidavit of contractors of payment to material suppliers and subcontractors. (See Article 36).
  4. Consent of Surety to Final Payment.
  5. Certificates of state agencies required by state law.
- f. The designer will not authorize final payment until the work under contract has been certified by designer, certificates of compliance issued, and the contractor has complied with the closeout requirements. The designer shall forward the contractor’s final application for payment to the owner along with respective certificate(s) of compliance required by law.

### **ARTICLE 33 - PAYMENTS WITHHELD**

- a. The designer with the approval of the State Construction Office may withhold payment for the following reasons:
  1. Faulty work not corrected.

2. The unpaid balance on the contract is insufficient to complete the work in the judgment of the designer.
  3. To provide for sufficient contract balance to cover liquidated damages that will be assessed.
- b. The secretary of the Department of Administration may authorize the withholding of payment for the following reasons:
    1. Claims filed against the contractor or evidence that a claim will be filed.
    2. Evidence that subcontractors have not been paid.
  - c. The Owner may withhold all or a portion of Contractor's general conditions costs set forth in the approved schedule of values, if Contractor has failed to comply with: (1) a request to access its records by Owner's internal auditors pursuant to Article 52; (2) a request for a plan of action and/or recovery schedule under Article 14.j or provide The Owner; (3) a request to provide an electronic copies of Contractor's baseline schedule, updates with all logic used to create the schedules in the original format of the scheduling software; and (4) Contractor's failure to have its Superintendent on the Project full-time; (
  - d. When grounds for withholding payments have been removed, payment will be released. Delay of payment due the contractor without cause will make owner liable for payment of interest to the contractor in accordance with G.S. 143-134.1. As provided in G.S.143-134.1(e) the owner shall not be liable for interest on payments withheld by the owner for unsatisfactory job progress, defective construction not remedied, disputed work, or third-party claims filed against the owner or reasonable evidence that a third-party claim will be filed.

## **ARTICLE 34 - MINIMUM INSURANCE REQUIREMENTS**

The work under this contract shall not commence until the contractor has obtained all required insurance and verifying certificates of insurance have been approved in writing by the owner. These certificates shall document that coverages afforded under the policies will not be cancelled, reduced in amount or coverages eliminated until at least thirty (30) days after mailing written notice, by certified mail, return receipt requested, to the insured and the owner of such alteration or cancellation. If endorsements are needed to comply with the notification or other requirements of this article copies of the endorsements shall be submitted with the certificates.

### **a. Worker's Compensation and Employer's Liability**

The contractor shall provide and maintain, until final acceptance, workmen's compensation insurance, as required by law, as well as employer's liability coverage with minimum limits of \$100,000.

### **b. Public Liability and Property Damage**

The contractor shall provide and maintain, until final acceptance, comprehensive general liability insurance, including coverage for premises operations, independent contractors, completed operations, products and contractual exposures, as shall protect such contractors from claims arising out of any bodily injury, including accidental death, as well as from claims for property damages which may arise from operations under this contract, whether such operations be by the contractor or by any subcontractor, or by

anyone directly or indirectly employed by either of them and the minimum limits of such insurance shall be as follows:

Bodily Injury: \$500,000 per occurrence  
Property Damage: \$100,000 per occurrence / \$300,000 aggregate

In lieu of limits listed above, a \$500,000 combined single limit shall satisfy both conditions.

Such coverage for completed operations must be maintained for at least two (2) years following final acceptance of the work performed under the contract.

**c. Property Insurance (Builder's Risk/Installation Floater)**

The contractor shall purchase and maintain property insurance until final acceptance, upon the entire work at the site to the full insurable value thereof. This insurance shall include the interests of the owner, the contractor, the subcontractors and sub-subcontractors in the work and shall insure against the perils of fire, wind, rain, flood, extended coverage, and vandalism and malicious mischief. If the owner is damaged by failure of the contractor to purchase or maintain such insurance, then the contractor shall bear all reasonable costs properly attributable thereto; the contractor shall effect and maintain similar property insurance on portions of the work stored off the site when request for payment per articles so includes such portions.

**d. Deductible**

Any deductible, if applicable to loss covered by insurance provided, is to be borne by the contractor.

**e. Other Insurance**

The contractor shall obtain such additional insurance as may be required by the owner or by the General Statutes of North Carolina including motor vehicle insurance, in amounts not less than the statutory limits.

**f. Proof of Carriage**

The contractor shall furnish the owner with satisfactory proof of carriage of the insurance required before written approval is granted by the owner.

**ARTICLE 35 - PERFORMANCE BOND AND PAYMENT BOND**

- a. Each contractor shall furnish a performance bond and payment bond executed by a surety company authorized to do business in North Carolina. The bonds shall be in the full contract amount. Bonds shall be executed in the form bound with these specifications.
- b. All bonds shall be countersigned by an authorized agent of the bonding company who is licensed to do business in North Carolina.

**ARTICLE 36 - CONTRACTOR'S AFFIDAVIT**

The final payment of retained amount due the contractor on account of the contract shall not become due until the contractor has furnished to the owner through the designer an affidavit signed, sworn and notarized to the effect that all payments for materials, services or subcontracted work in connection with his contract have been satisfied, and that no claims or

liens exist against the contractor in connection with this contract. In the event that the contractor cannot obtain similar affidavits from subcontractors to protect the contractor and the owner from possible liens or claims against the subcontractor, the contractor shall state in his affidavit that no claims or liens exist against any subcontractor to the best of his (the contractor's) knowledge, and if any appear afterward, the contractor shall save the owner harmless.

#### **ARTICLE 37 - ASSIGNMENTS**

The contractor shall not assign any portion of this contract nor subcontract in its entirety. Except as may be required under terms of the performance bond or payment bond, no funds or sums of money due or become due the contractor under the contract may be assigned.

#### **ARTICLE 38 - USE OF PREMISES**

- a. The contractor(s) shall confine his apparatus, the storage of materials and the operations of his workmen to limits indicated by law, ordinances, permits or directions of the designer and owner and shall not exceed those established limits in his operations.
- b. The contractor(s) shall not load or permit any part of the structure to be loaded with a weight that will endanger its safety.
- c. The contractor(s) shall enforce the designer's and owner's instructions regarding signs, advertisements, fires and smoking.
- d. No firearms, any type of alcoholic beverages, or drugs (other than those prescribed by a physician) will be permitted at the job site.

#### **ARTICLE 39 - CUTTING, PATCHING AND DIGGING**

- a. The contractor shall do all cutting, fitting or patching of his work that may be required to make its several parts come together properly and fit it to receive or be received by work of other contractors shown upon or reasonably implied by the drawings and specifications for the completed structure, as the designer may direct.
- b. Any cost brought about by defective or ill-timed work shall be borne by the party responsible therefor.
- c. No contractor shall endanger any work of another contractor by cutting, digging or other means. No contractor shall cut or alter the work of any other contractor without the consent of the designer and the affected contractor(s).

#### **ARTICLE 40 - UTILITIES, STRUCTURES, SIGNS**

- a. The contractor shall provide necessary and adequate facilities for water, electricity, gas, oil, sewer and other utility services which maybe necessary and required for completion of the project including all utilities required for testing, cleaning, balancing, and sterilization of designated plumbing, mechanical and electrical systems. Any permanent meters installed shall be listed in the contractor's name until work has a final acceptance. The contractor will be solely responsible for all utility costs prior to final acceptance. Contractor shall contact all affected utility companies prior to bid to determine their requirements to provide temporary and permanent service and include all costs associated with providing those services in their bid. Coordination of the work of the utility companies during construction is the sole responsibility of the contractor.

- b. Meters shall be relisted in the owner's name on the day following final acceptance of the Project Expediter's work, and the owner shall pay for services used after that date.
- c. The owner shall be reimbursed for all metered utility charges after the meter is relisted in the owner's name and prior to completion and acceptance of the work of **all** contractors. Reimbursement shall be made by the contractor whose work has not been completed and accepted. If the work of two or more contractors has not been completed and accepted, reimbursement to the owner shall be paid by the contractors involved on the basis of assessments by the designer.
- d. Prior to the operation of permanent systems, the Project Expediter will provide temporary power, lighting, water, and heat to maintain space temperature above freezing, as required for construction operations.
- e. All contractors shall have the permanent building systems in sufficient readiness for furnishing temporary climatic control at the time a building is enclosed and secured. The HVAC systems shall maintain climatic control throughout the enclosed portion of the building sufficient to allow completion of the interior finishes of the building. A building shall be considered enclosed and secured when windows, doorways (exterior, mechanical, and electrical equipment rooms), and hardware are installed; and other openings have protection which will provide reasonable climatic control. The appropriate time to start the mechanical systems and climatic condition shall be jointly determined by the contractor(s), the designer and owner. Use of the equipment in this manner shall be subject to the approval of the Designer and owner and shall in no way affect the warranty requirements of the contractor(s).
- f. The electrical contractor shall have the building's permanent power wiring distribution system in sufficient readiness to provide power as required by the HVAC contractor for temporary climatic control.
- g. The electrical contractor shall have the building's permanent lighting system ready at the time the general contractor begins interior painting and shall provide adequate lighting in those areas where interior painting and finishing is being performed.
- h. Each prime contractor shall be responsible for his permanently fixed service facilities and systems in use during progress of the work. The following procedures shall be strictly adhered to:
  - 1. Prior to final acceptance of work by the State Construction Office, each contractor shall remove and replace any parts of the permanent building systems damaged through use during construction.
  - 2. Temporary filters as recommended by the equipment manufacturer in order to keep the equipment and ductwork clean and free of dust and debris shall be installed in each of the heating and air conditioning units and at each return grille during construction. New filters shall be installed in each unit prior to the owner's acceptance of the work.
  - 3. Extra effort shall be maintained to keep the building and the site adjacent to the building clean and under no circumstances shall air systems be operated if finishing and site work operations are creating dust in excess of what would be considered normal if the building were occupied.
  - 4. It shall be understood that any warranty on equipment presented to the owner shall extend from the day of final acceptance by the owner. The cost of warranting the



equipment during operation in the finishing stages of construction shall be borne by the contractor whose system is utilized.

5. The electrical contractor shall have all lamps in proper working condition at the time of final project acceptance.
  - i. The Project Expediter shall provide, if required and where directed, a shed for toilet facilities and shall furnish and install in this shed all water closets required for a complete and adequate sanitary arrangement. These facilities will be available to other contractors on the job and shall be kept in a neat and sanitary condition at all times. Chemical toilets are acceptable.
  - j. The Project Expediter shall, if required by the Supplementary General Conditions and where directed, erect a temporary field office, complete with lights, telephone, heat and air conditioning. A portion of this office shall be partitioned off, of sufficient size, for the use of a resident inspector, should the designer so direct.
  - k. On multi-story construction projects, the Project Expediter shall provide temporary elevators, lifts, or other special equipment for the general use of all contractors. The cost for such elevators, lifts or other special equipment and the operation thereof shall be included in the Project Expediter's bid.
  - l. The Project Expediter will erect one sign on the project if required. The sign shall be of sound construction, and shall be neatly lettered with black letters on white background. The sign shall bear the name of the project, and the names of prime contractors on the project, and the name of the designer and consultants. Directional signs may be erected on the owner's property subject to approval of the owner with respect to size, style and location of such directional signs. Such signs may bear the name of the contractor and a directional symbol. No other signs will be permitted except by permission of the owner.

#### **ARTICLE 41 - CLEANING UP**

- a. The contractors shall keep the building and surrounding area reasonably free from rubbish at all times, and shall remove debris from the site on a timely basis or when directed to do so by the designer or Project Expediter. The Project Expediter shall provide an on site refuse container(s) for the use of all contractors. Each contractor shall remove their rubbish and debris from the building on a daily basis. The Project Expediter shall broom clean the building as required to minimize dust and dirt accumulation.
- b. The Project Expediter shall provide and maintain suitable all-weather access to the building.
- c. Before final inspection and acceptance of the building, each contractor shall clean his portion of the work, including glass, hardware, fixtures, masonry, tile and marble (using no acid), clean and wax all floors as specified, and completely prepare the building for use by the owner, with no cleaning required by the owner.

#### **ARTICLE 42 - GUARANTEE**

- a. The contractor shall unconditionally guarantee materials and workmanship against patent defects arising from faulty materials, faulty workmanship or negligence for a period of twelve (12) months following the date of final acceptance of the work or beneficial occupancy and shall replace such defective materials or workmanship without cost to the owner.

- b. Where items of equipment or material carry a manufacturer's warranty for any period in excess of twelve (12) months, then the manufacturer's warranty shall apply for that particular piece of equipment or material. The contractor shall replace such defective equipment or materials, without cost to the owner, within the manufacturer's warranty period.
- c. Additionally, the owner may bring an action for latent defects caused by the negligence of the contractor which is hidden or not readily apparent to the owner at the time of beneficial occupancy or final acceptance, whichever occurred first, in accordance with applicable law.
- d. Guarantees for roof, equipment, materials, and supplies shall be stipulated in the specifications sections governing such roof, equipment, materials, or supplies.

#### **ARTICLE 43 - CODES AND STANDARDS**

Wherever reference is given to codes, standard specifications or other data published by regulating agencies including, but not limited to, national electrical codes, North Carolina state building codes, federal specifications, ASTM specifications, various institute specifications, etc., it shall be understood that such reference is to the latest edition including addenda published prior to the date of the contract documents.

#### **ARTICLE 44 - INDEMNIFICATION**

To the fullest extent permitted by law, the contractor shall indemnify and hold harmless the owner, the designer and the agents, consultants and employees of the owner and designer, from and against all claims, damages, losses and expenses, including, but not limited to, attorneys' fees, arising out of or resulting from the performance or failure of performance of the work, provided that any such claim, damage, loss or expense (1) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the work itself) including the loss of use resulting there from, and (2) is caused in whole or in part by any negligent act or omission of the contractor, the contractor's subcontractor, or the agents of either the contractor or the contractor's subcontractor. Such obligation shall not be construed to negate, abridge or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person described in this article.

#### **ARTICLE 45 - TAXES**

- a. Federal excise taxes do not apply to materials entering into state work (Internal Revenue Code, Section 3442(3)).
- b. Federal transportation taxes do not apply to materials entering into state work (Internal Revenue Code, Section 3475(b) as amended).
- c. North Carolina sales tax and use tax, as required by law, do apply to materials entering into state work and such costs shall be included in the bid proposal and contract sum.
- d. Local option sales and use taxes, as required by law, do apply to materials entering into state work as applicable and such costs shall be included in the bid proposal and contract sum.
- e. **Accounting Procedures for Refund of County Sales & Use Tax**

Amount of county sales and use tax paid per contractor's statements:

Contractors performing contracts for state agencies shall give the state agency for whose project the property was purchased a signed statement containing the information listed in G.S. 105-164.14(e).

The Department of Revenue has agreed that in lieu of obtaining copies of sales receipts from contractors, an agency may obtain a certified statement as of April 1, 1991 from the contractor setting forth the date, the type of property and the cost of the property purchased from each vendor, the county in which the vendor made the sale and the amount of local sales and use taxes paid thereon. If the property was purchased out-of-state, the county in which the property was delivered should be listed. The contractor should also be notified that the certified statement may be subject to audit.

In the event the contractors make several purchases from the same vendor, such certified statement must indicate the invoice numbers, the inclusive dates of the invoices, the total amount of the invoices, the counties, and the county sales and use taxes paid thereon.

Name of taxing county: The position of a sale is the retailer's place of business located within a taxing county where the vendor becomes contractually obligated to make the sale. Therefore, it is important that the county tax be reported for the county of sale rather than the county of use.

When property is purchased from out-of-state vendors and the county tax is charged, the county should be identified where delivery is made when reporting the county tax.

Such statement must also include the cost of any tangible personal property withdrawn from the contractor's warehouse stock and the amount of county sales or use tax paid thereon by the contractor.

Similar certified statements by his subcontractors must be obtained by the general contractor and furnished to the claimant.

Contractors are not to include any tax paid on supplies, tools and equipment which they use to perform their contracts and should include only those building materials, supplies, fixtures and equipment which actually become a part of or annexed to the building or structure.

#### **ARTICLE 46 - EQUAL OPPORTUNITY CLAUSE**

The non-discrimination clause contained in Section 202 (Federal) Executive Order 11246, as amended by Executive Order 11375, relative to equal employment opportunity for all persons without regard to race, color, religion, sex or national origin, and the implementing rules and regulations prescribed by the secretary of Labor, are incorporated herein.

#### **ARTICLE 47 - EMPLOYMENT OF INDIVIDUALS WITH DISABILITIES**

The contractor(s) agree not to discriminate against any employee or applicant for employment because of physical or mental disabilities in regard to any position for which the employee or applicant is qualified. The contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified individuals with such disabilities without discrimination based upon their physical or mental disability in all employment practices.

#### **ARTICLE 48 - ASBESTOS-CONTAINING MATERIALS (ACM)**

The State of North Carolina has attempted to address all asbestos-containing materials that are to be disturbed in the project. However, there may be other asbestos-containing materials in the work areas that are not to be disturbed and do not create an exposure hazard.

Contractors are reminded of the requirements of instructions under Instructions to Bidders and General Conditions of the Contract, titled Examination of Conditions. Statute 130A, Article 19, amended August 3, 1989, established the Asbestos Hazard Management Program that controls asbestos abatement in North Carolina. The latest edition of *Guideline Criteria for Asbestos Abatement* from the State Construction Office is to be incorporated in all asbestos abatement projects for the Capital Improvement Program.

#### **ARTICLE 49 - MINORITY BUSINESS PARTICIPATION**

GS 143-128.2 establishes a ten percent (10%) goal for participation by minority businesses in total value of work for each State building project. The document, *Guidelines for Recruitment and Selection of Minority Businesses for Participation in State Construction Contracts* including Affidavits and Appendix E are hereby incorporated into and made a part of this contract.

#### **ARTICLE 50 – CONTRACTOR EVALUATION**

The contractor's overall work performance on the project shall be fairly evaluated in accordance with the State Building Commission policy and procedures, for determining qualifications to bid on future State capital improvement projects. In addition to final evaluation, interim evaluation may be prepared during the progress of project. The document, Contractor Evaluation Procedures, is hereby incorporated and made a part of this contract. The owner may request the contractor's comments to evaluate the designer.

#### **ARTICLE 51 – GIFTS**

Pursuant to N.C. Gen. Stat. § 133-32, it is unlawful for any vendor or contractor ( i.e. architect, bidder, contractor, construction manager, design professional, engineer, subcontractor, supplier, vendor, etc.), to make gifts or to give favors to any State employee. This prohibition covers those vendors and contractors who: (1) have a contract with a governmental agency; or (2) have performed under such a contract within the past year; or (3) anticipate bidding on such a contract in the future. For additional information regarding the specific requirements and exemptions, vendors and contractors are encouraged to review G.S. Sec. 133-32.

During the construction of the Project, the Contractor is prohibited from making gifts to any of the Owner's employees, Owner's project representatives (architect, engineers, construction manager and their employees), employees of the State Construction Office and/or any other State employee that may have any involvement, influence, responsibilities, oversight, management and/or duties that pertain to and/or relate to the contract administration, financial administration and/or disposition of claims arising from and/or relating to the Contract and/or Project.

#### **ARTICLE 52 – AUDITING-ACCESS TO PERSONS AND RECORDS**

In accordance with N.C. General Statute 147-64.7, the State Auditor shall have access to Contractor's officers, employees, agents and/or other persons in control of and/or responsible for the Contractor's records that relate to this Contracts for purposes of conducting audits under the referenced statute. The Owner's internal auditors shall also have the right to access and copy the Contractor's records relating to the Contract and Project during the term of the Contract and within two years following the completion of the Project/close-out of the Contract to verify accounts, accuracy, information, calculations and/or data affecting and/or

relating to Contractor's requests for payment, requests for change orders, change orders, claims for extra work, requests for time extensions and related claims for delay/extended general conditions costs, claims for lost productivity, claims for loss efficiency, claims for idle equipment or labor, claims for price/cost escalation, pass-through claims of subcontractors and/or suppliers, and/or any other type of claim for payment or damages from Owner and/or its project representatives.

## **ARTICLE 53 – NORTH CAROLINA FALSE CLAIMS ACT**

The North Carolina False Claims Act ("NCFCA"), N.C. Gen. Stat. § 1-605 through 1-618, applies to this Contract. The Contractor should familiarize itself with the entire NCFCA and should seek the assistance of an attorney if it has any questions regarding the NCFCA and its applicability to any requests, demands and/or claims for payment its submits to the State through the contracting state agency, institution, university or community college.

The purpose of the NCFCA "is to deter persons from knowingly causing or assisting in causing the State to pay claims that are false or fraudulent and to provide remedies in the form of treble damages and civil penalties when money is obtained from the State by reason of a false or fraudulent claim." (Section 1-605(b).) A contractor's liability under the NCFCA may arise from, but is not limited to: requests for payment, invoices, billing, claims for extra work, requests for change orders, requests for time extensions, claims for delay damages/extended general conditions costs, claims for lost productivity, claims for loss efficiency, claims for idle equipment or labor, claims for price/cost escalation, pass-through claims of subcontractors and/or suppliers, documentation used to support any of the foregoing requests or claims, and/or any other request for payment from the State through the contracting state agency, institution, university or community college. The parts of the NCFCA that are most likely to be enforced with respect to this type of contract are as follows:

- A "claim" is "[a]ny request or demand, whether under a contract or otherwise, for money or property and whether or not the State has title to the money or property that (i) is presented to an officer, employee, or agent of the State or (ii) is made to a contractor ... if the money or property is to be spent or used on the State's behalf or to advance a State program or interest and if the State government: (a) provides or has provided any portion of the money or property that is requested or demanded; or (b) will reimburse such contractor ... for any portion of the money or property which is requested or demanded." (Section 1-606(2).)
- "Knowing" and "knowingly." – Whenever a person, with respect to information, does any of the following: (a) Has actual knowledge of the information; (b) Acts in deliberate ignorance of the truth or falsity of the information; and/or (c) Acts in reckless disregard of the truth or falsity of the information. (Section 1-606(4).) Proof of specific intent to defraud is not required. (Section 1-606(4).)
- "Material" means having a natural tendency to influence, or be capable of influencing, the payment or receipt of money or property. (Section 1-606(4).)
- Liability. – "Any person who commits any of the following acts shall be liable to the State for three times the amount of damages that the State sustains because of the act of that person[:]. ... (1) Knowingly presents or causes to be presented a false or fraudulent claim for payment or approval. (2) Knowingly makes, uses, or causes to be made or used, a false record or statement material to a false or fraudulent claim. (3) Conspires to commit a violation of subdivision (1), (2) ..." (Section 1-607(a)(1), (2).)

- The NCFCA shall be interpreted and construed so as to be consistent with the federal False Claims Act, 31 U.S.C. § 3729, et seq., and any subsequent amendments to that act. (Section 1-616(c).)

Finally, the contracting state agency, institution, university or community college may refer any suspected violation of the NCFCA by the Contractor to the Attorney General's Office for investigation. Under Section 1-608(a), the Attorney General is responsible for investigating any violation of NCFCA, and may bring a civil action against the Contractor under the NCFCA. The Attorney General's investigation and any civil action relating thereto are independent and not subject to any dispute resolution provision set forth in this Contract. (See Section 1-608(a).)

#### **ARTICLE 54 – TERMINATION FOR CONVENIENCE**

Owner may at any time and for any reason terminate Contractor's services and work at Owner's convenience. Upon receipt of such notice, Contractor shall, unless the notice directs otherwise, immediately discontinue the work and placing of orders for materials, facilities and supplies in connection with the performance of this Agreement.

Upon such termination, Contractor shall be entitled to payment only as follows: (1) the actual cost of the work completed in conformity with this Agreement; plus, (2) such other costs actually incurred by Contractor as are permitted by the prime contract and approved by Owner; (3) plus ten percent (10%) of the cost of the work referred to in subparagraph (1) above for overhead and profit. There shall be deducted from such sums as provided in this subparagraph the amount of any payments made to Contractor prior to the date of the termination of this Agreement. Contractor shall not be entitled to any claim or claim of lien against Owner for any additional compensation or damages in the event of such termination and payment.

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## **Special Requirements of the Formal Contract**

**Revised December 21, 2017**

The following special requirements of the contract augment the State Construction Office, North Carolina Department of Administration Form OC-15, 24<sup>th</sup> Edition "General Conditions,". Where any article of the General Conditions is modified or any Paragraph, Subparagraph or Clause thereof is modified or deleted by these special requirements, the unaltered provisions of that Article, Paragraph, Subparagraph or Clause shall remain in effect.

### **ARTICLE 4 - COPIES OF DRAWINGS AND SPECIFICATIONS**

The Designer shall furnish free of charge to the General Contractor (GC) or Construction Manager (CM) an electronic copy in PDF format of the bid documents. Paper copies of drawing sets and specifications shall be furnished at cost, including mailing at the request of the General Contractor or Construction Manager.

### **ARTICLE 5 - SHOP DRAWINGS, SUBMITTALS, SAMPLES, DATA**

The GC/CM shall submit with initial approval of the design documents for compliance and accuracy, electronic copies in PDF format of all shop drawings and submittals. Physical samples shall be submitted for color and workmanship (mock-up) approval.

All Shop Drawings, Samples and Submittals for approval shall be completed within thirty (30) days after award of the sub-contract agreement between the GC/CM and the specialty subcontractor.

### **ARTICLE 6 - WORKING DRAWINGS AND SPECIFICATIONS AT THE JOB SITE**

The GC/CM shall submit a copy of the daily field reports by its field supervision listing but not limited to personnel on site (including all subcontractors); weather conditions; major scopes of work under construction; material deliveries; safety incidents; progress photographs, and inspections.

### **ARTICLE 8 - MATERIALS, EQUIPMENT, EMPLOYEES**

The GC/CM shall provide the Owner a complete list of addresses and emergency telephone numbers for the GC/CM, his key personnel, and all subcontractors. This list shall be provided to the Owner prior to beginning the Work and shall be updated regularly with the updated provided to the Owner.

The GC/CM acknowledges and agrees that, to the best of its knowledge, neither GC/CM nor its employees, representatives or sub-contractors has at any time (1) been charged with personal or professional misconduct; (2) been convicted of any crime (other than traffic fines); (3) been required to register as a sex offender under Title I of the Sex Offender Registration and Notification Act of 2006 (SORNA). GC/CM shall notify Owner **immediately** should any of the above conditions come into being.

The GC/CM and subcontractors shall verify the work authorization of all employees that work on Western Carolina University property through E-Verify. Such authorization will be made available to Western Carolina University upon request.

Should an accident or disruption occur on the project work site, the GC/CM shall notify Western Carolina University Safety Officer immediately.



## **ARTICLE 10 - PERMITS, INSPECTIONS, FEES, REGULATIONS**

A minimum of (72) hours prior to any interruption in any utility or other services, the GC/CM shall request and obtain permission from the Owner for such interruption. Failure of the GC/CM obtain Owner permission shall not be grounds for an extension of time.

Prior to performing any "hot work" or any work above ceiling in existing buildings, the GC/CM shall obtain a permit for such from the Owner's Facilities Management Department.

The GC/CM shall comply with Owner's Interim Life Safety Plan requirements to maintain egress from all occupied buildings.

Upon completion of the Work, the Contractor shall deliver to the Owner original copies of all required certificates of inspection.

## **ARTICLE 14 - CONSTRUCTION SUPERVISION AND SCHEDULE**

CPM schedule shall indicate early start; early finish; late start; late finish; and float for each listed task.

Critical Path shall be defined as zero float.

Promptly following Contract Award, the Contractor shall hold a meeting for the purpose of establishing and preparing Contractor's construction schedule for the Work. Each major subcontractor shall be represented. The Contractor's construction schedule shall be in a detailed format satisfactory to the Owner and the Architect. If not accepted, the construction schedule shall be promptly revised by the Contractor in accordance with the recommendations of the Owner and the Architect and re-submitted for acceptance. The Contractor's construction schedule shall be sufficiently detailed to permit proper and complete coordination of all trades in each portion of the Work. Therefore, the Contractor's construction schedule shall specifically indicate the following dates:

- Dates scheduled for completion of installation of major items of equipment.
- The anticipated date of Substantial Completion.
- The date of Final Completion of the Project, as established by the Contract.

The accepted Contractor's construction schedule, bearing the approval signature of the Contractor and major subcontractors, shall be distributed to all interested parties in quantities as required. No application for payment will be approved until the Contractor's construction schedule has been received and accepted by Owner.

## **ARTICLE 23 - TIME OF COMPLETION, DELAYS, EXTENSION OF TIME**

Liquidated damages in the amount of \$200.00 per day will be assessed of each day the schedule of the Work exceeds 14 days beyond the contractual duration set forth in the contract or therefore extended by approved change order.

## **ARTICLE 34 - MINIMUM INSURANCE REQUIREMENTS**

GC/CM shall provide and maintain, or cause to be provided or maintained in the case of sub-consultants to GC/CM, the following insurance at GC/CM's sole expense:

**1. General Liability insurance** (the "GL Insurance") for claims and all perils for errors, omissions, occurrences, property damage, bodily injury, contractual liability, and damages of any kind or character which may arise out of or result from GC/CM's performance under this Agreement. The GL Insurance shall be written with limits of coverage of no less than \$1,000,000 per occurrence, \$1,000,000 aggregate per year.

**2. Automobile Liability insurance** (the “Auto Insurance”) for claims and all perils for errors, omissions, and damages of any kind or character which may arise out of or result from GC/CM’s performance under this Agreement. The Auto Insurance shall cover owned, non-owned, and hired vehicles. The Auto Insurance shall be written in the amount of no less than \$1,000,000 Combined Single Limit (property and bodily injury) per occurrence.

**3. Workers’ Compensation insurance** (the “WC Insurance”) insuring the GC/CM and GC/CM’s employees in such amounts as otherwise required by applicable law. Employer’s liability insurance (the “EL Insurance”) for claims and all perils for errors, omissions, and damages of any kind or character which may arise out of or result from GC/CM’s performance under this Agreement. The EL Insurance shall be written with limits of coverage of no less than \$100,000 per occurrence.

**4. Builders Risk insurance** – The GC/CM shall purchase and maintain property insurance until final acceptance, upon the entire work at the site to the full insurable value thereof. This insurance shall include the interests of the owner, the GC/CM, the subcontractors and sub-subcontractors in the work and shall insure against the perils of fire, wind, rain, flood, extended coverage, and vandalism and malicious mischief. If the owner is damaged by failure of the GC/CM to purchase or maintain such insurance, then the GC/CM shall bear all reasonable costs properly attributable thereto.

All insurance required shall be written by a company or companies with a current and ongoing A.M. Best rating of “A” or better lawfully authorized to do business in North Carolina. Insurance shall be written on a first dollar basis without application of a deductible or self-insured retention.

If insurance is written on a claims-made basis, GC/CM shall purchase and maintain an unlimited term extended reporting period endorsement (“Tail Insurance”) on the same terms and conditions as otherwise required herein upon cancellation or non-renewal of the respective insurance for any reason. All insurance and Tail Insurance required shall be primary and noncontributory to any other insurance coverage available.

All insurance required shall be endorsed to specify that, without thirty (30) days prior written notice to Western Carolina University (WCU), the insurance shall not be canceled, non-renewed, or coverage and/or limits materially altered. The endorsement shall also provide that the notices required by this paragraph be sent by certified mail to WCU at the notice address otherwise provided by this Agreement. Prior to commencing work under this Agreement, GC/CM shall provide WCU with certificates of insurance evidencing the insurance required under this paragraph.

Provide insurance certificate(s) to this office with language appropriately inserted in the insurance certificate block provided for Special Provisions, as follows: *“Notwithstanding the preprinted cancellation provisions on this form, coverages afforded under the policies will not be cancelled, reduced in amount nor will any coverages be eliminated until at least thirty (30) days after mailing written notice, by certified mail, return receipt requested, to the insured and the owner, of such alteration or cancellation.”*

#### **ARTICLE 41 - CLEANING UP**

Contractor to compile with Owner’s requirements for Interim Life Safety Plan requirements.

#### **ARTICLE 42 - GUARANTEE**

In addition to the individual guarantees and warranties provided for components of the Work, the Contractor shall provide a general warranty on the entire Work, for a period of 12 months, in the form provided within the Project Manual, warranting the quality and performance of the Work in accordance with these stipulations.

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## ADVERTISEMENT FOR BIDS

Sealed proposals will be received until **3:00PM**  
(Time)

on **December 9<sup>th</sup>, 2021** , in **WCU Facilities Management Office,**  
(Date) (Location)

for the construction of

**Stillwell Backfill Renovations**  
(Project)

at which time and place bids will be opened and read.

Complete plans and specification for this project can be examined during normal office hours at **PFA Architects, PA, located at 196 Coxe Ave., Asheville, NC 28801.** (Designer). Hours: 8am-5pm Mon-Thur and 8am-12 pm/noon Fri.; as well as at Henco Reprographics after **October 7th, 2021.**

and in the plan rooms of the Associated General Contractors, Carolinas Branch, Charlotte in the local North Carolina offices of McGraw-Hill Dodge Corporation, and in the Eastern Regional Office of Reed Construction Data in Norcross, GA and also in Minority Plan Rooms including:

- Hispanic Contractors Association of the Carolinas (HCAC) in Winston-Salem, Charlotte, and Raleigh Areas 877-227-1680
- Metrolina Minority Contractors Association, 3124 W. Trade Street, Unit A, Charlotte, NC 28202. Ph. 704-332-5746 Fax: 704-332-5990
- Henco Reprographics, 54 Broadway, Asheville, NC 28801 Phone: 828-253-0449 Website: [hencoplanroom.com](http://hencoplanroom.com)
- Construction Market Data (formerly Reed Construction Data) at [www.cmdgroup.com](http://www.cmdgroup.com)

Copies of the Contract Documents may be obtained, after October 7, 2021, directly from:

Henco Reprographics

Website: [www.hencoplanroom.com](http://www.hencoplanroom.com)

54 Broadway, Asheville, NC 28801

Phone: 828-253-0449

Hours of Business: M-F 8am-5:30pm

Hard Copies: **Refundable Plan Deposit of \$250.00**

Digital Copies: **Non-Refundable Purchase Price of \$100.00**

The state reserves the unqualified right to reject any and all proposals.

Signed:

**Western Carolina University**

**3476 Old Cullowhee Road**

**Cullowhee, NC 28723**

**828-227-7224**

(Owner)

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**FORM OF BID BOND**

KNOW ALL MEN BY THESE PRESENTS THAT \_\_\_\_\_

\_\_\_\_\_ as principal, and \_\_\_\_\_, as surety, who is duly licensed to act as surety in North Carolina, are held and firmly bound unto the State of North Carolina\* through \_\_\_\_\_ as obligee, in the penal sum of \_\_\_\_\_ DOLLARS, lawful money of the United States of America, for the payment of which, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

Signed, sealed and dated this \_\_\_\_ day of \_\_\_\_ 20\_\_

WHEREAS, the said principal is herewith submitting proposal for and the principal desires to file this bid bond in lieu of making the cash deposit as required by G.S. 143-129.

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION is such, that if the principal shall be awarded the contract for which the bid is submitted and shall execute the contract and give bond for the faithful performance thereof within ten days after the award of same to the principal, then this obligation shall be null and void; but if the principal fails to so execute such contract and give performance bond as required by G.S. 143-129, the surety shall, upon demand, forthwith pay to the obligee the amount set forth in the first paragraph hereof. Provided further, that the bid may be withdrawn as provided by G.S. 143-129.1

\_\_\_\_\_(SEAL)

\_\_\_\_\_(SEAL)

\_\_\_\_\_(SEAL)

\_\_\_\_\_(SEAL)

\_\_\_\_\_(SEAL)

\*(Community college projects: Delete State of North Carolina as owner and replace with community college name.)

**STATE CONSTRUCTION OFFICE**

**BID SUMMARY SHEET**

**DESIGNER:** Lord Aeck Sargent, Inc.  
**OWNER/AGENCY:** State of North Carolina/Western Carolina University  
**PROJECT NAME:** Stillwell Backfill  
**CODE & ITEM** \_\_\_\_\_  
**SCO FILE#:** 16-15506-04D  
**DATE BIDS RECEIVED:** \_\_\_\_\_  
**PROJECT SIZE: (Sq Ft., Etc.)** 4,625 sf Selective Interior Renovation  
**COUNTY OF PROJECT:** Jackson

**GENERAL CONSTRUCTION**                      **LOW BID**                      **\$/UNIT COST**

AVERAGE OF 3 LOWEST BIDS                      \_\_\_\_\_                      \_\_\_\_\_  
ESTIMATED BID                      \_\_\_\_\_                      \_\_\_\_\_  
OVER/ (UNDER) BUDGET                      \_\_\_\_\_                      \_\_\_\_\_

**MECHANICAL**    **LOW BID**                      **\$/UNIT COST**

AVERAGE OF 3 LOWEST BIDS                      \_\_\_\_\_                      \_\_\_\_\_  
ESTIMATED BID                      \_\_\_\_\_                      \_\_\_\_\_  
OVER/ (UNDER) BUDGET                      \_\_\_\_\_                      \_\_\_\_\_

**ELECTRICAL**    **LOW BID**                      **\$/UNIT COST**

AVERAGE OF 3 LOWEST BIDS                      \_\_\_\_\_                      \_\_\_\_\_  
ESTIMATED BID                      \_\_\_\_\_                      \_\_\_\_\_  
OVER/ (UNDER) BUDGET                      \_\_\_\_\_                      \_\_\_\_\_

**PLUMBING**    **LOW BID**                      **\$/UNIT COST**

AVERAGE OF 3 LOWEST BIDS                      \_\_\_\_\_                      \_\_\_\_\_  
ESTIMATED BID                      \_\_\_\_\_                      \_\_\_\_\_  
OVER/ (UNDER) BUDGET                      \_\_\_\_\_                      \_\_\_\_\_

**OTHER**    **LOW BID**                      **\$/UNIT COST**

AVERAGE OF 3 LOWEST BIDS                      \_\_\_\_\_                      \_\_\_\_\_  
ESTIMATED BID                      \_\_\_\_\_                      \_\_\_\_\_  
OVER/ (UNDER) BUDGET                      \_\_\_\_\_                      \_\_\_\_\_

**OTHER**    **LOW BID**                      **\$/UNIT COST**

AVERAGE OF 3 LOWEST BIDS                      \_\_\_\_\_                      \_\_\_\_\_  
ESTIMATED BID                      \_\_\_\_\_                      \_\_\_\_\_  
OVER/ (UNDER) BUDGET                      \_\_\_\_\_                      \_\_\_\_\_





**FORM OF CONSTRUCTION CONTRACT**

(ALL PRIME CONTRACTS)

THIS AGREEMENT, made the \_\_\_\_\_ day of \_\_\_\_\_ in the year of 20\_\_ by \_\_\_\_\_ and \_\_\_\_\_ between \_\_\_\_\_

hereinafter called the Party of the First Part and the State of North Carolina, through the Western Carolina University hereinafter called the Party of the Second Part.

**WITNESSETH:**

That the Party of the First Part and the Party of the Second Part for the consideration herein named agree as follows:

1. Scope of Work: The Party of the First Part shall furnish and deliver all of the materials, and perform all of the work in the manner and form as provided by the following enumerated plans, specifications and documents, which are attached hereto and made a part thereof as if fully contained herein: advertisement; Instructions to Bidders; General Conditions; Supplementary General Conditions; specifications; accepted proposal; contract; performance bond; payment bond; power of attorney; workmen's compensation; public liability; property damage and builder's risk insurance certificates; approval of attorney general; certificate by the Office of State Budget and Management, and drawings, titled:

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

Consisting of the following sheets:

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

Dated: \_\_\_\_\_ and the following addenda:

Addendum No. \_\_\_\_\_ Dated: \_\_\_\_\_ Addendum No. \_\_\_\_\_ Dated: \_\_\_\_\_

Addendum No. \_\_\_\_\_ Dated: \_\_\_\_\_ Addendum No. \_\_\_\_\_ Dated: \_\_\_\_\_

Addendum No. \_\_\_\_\_ Dated: \_\_\_\_\_ Addendum No. \_\_\_\_\_ Dated: \_\_\_\_\_

Addendum No. \_\_\_\_\_ Dated: \_\_\_\_\_ Addendum No. \_\_\_\_\_ Dated: \_\_\_\_\_

2. That the Party of the First Part shall commence work to be performed under this agreement on a date to be specified in a written order of the Party of the Second Part and shall fully complete all work hereunder within **one hundred-fifty (150)** consecutive calendar days from said date. For each day in excess thereof, liquidated damages shall be as stated in Supplementary General Conditions. The Party of the First Part, as one of the considerations for the awarding of this contract, shall furnish to the Party of the Second

Part a construction schedule setting forth planned progress of the project broken down by the various divisions or part of the work and by calendar days as outlined in Article 14 of the General Conditions of the Contract.

3. The Party of the Second Part hereby agrees to pay to the Party of the First Part for the faithful performance of this agreement, subject to additions and deductions as provided in the specifications or proposal, in lawful money of the United States as follows:

---

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

Summary of Contract Award:

4. In accordance with Article 31 and Article 32 of the General Conditions of the Contract, the Party of the Second Part shall review, and if approved, process the Party of the First Party's pay request within 30 days upon receipt from the Designer. The Party of the Second Part, after reviewing and approving said pay request, shall make payments to the Party of the First Part on the basis of a duly certified and approved estimate of work performed during the preceding calendar month by the First Party, less five percent (5%) of the amount of such estimate which is to be retained by the Second Party until all work has been performed strictly in accordance with this agreement and until such work has been accepted by the Second Party. The Second Party may elect to waive retainage requirements after 50 percent of the work has been satisfactorily completed on schedule as referred to in Article 31 of the General Conditions.

5. Upon submission by the First Party of evidence satisfactory to the Second Party that all payrolls, material bills and other costs incurred by the First Party in connection with the construction of the work have been paid in full, final payment on account of this agreement shall be made within thirty (30) days after the completion by the First Party of all work covered by this agreement and the acceptance of such work by the Second Party.

6. It is further mutually agreed between the parties hereto that if at any time after the execution of this agreement and the surety bonds hereto attached for its faithful performance, the Second Party shall deem the surety or sureties upon such bonds to be unsatisfactory, or if, for any reason, such bonds cease to be adequate to cover the performance of the work, the First Party shall, at its expense, within five (5) days after the receipt of notice from the Second Party so to do, furnish an additional bond or bonds in such form and amount, and with such surety or sureties as shall be satisfactory to the Second Party. In such event no further payment to the First Party shall be deemed to be due under this agreement until such new or additional security for the faithful performance of the work shall be furnished in manner and form satisfactory to the Second Party.

7. The Party of the First Part attest that it and all of its subcontractors have fully complied with all requirements of NCGS 64 Article 2 in regards to E-Verification as required by Section 2.(c) of Session Law 2013-418, codified as N.C. Gen. Stat. § 143-129(j).

IN WITNESS WHEREOF, the Parties hereto have executed this agreement on the day and date first above written in \_\_\_\_\_ counterparts, each of which shall without proof or accounting for other counterparts, be deemed an original contract.

Witness:

\_\_\_\_\_  
Contractor: (Trade or Corporate Name)

\_\_\_\_\_  
(Proprietorship or Partnership)

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

Title: \_\_\_\_\_  
(Owner, Partner, or Corp. Pres. or Vice Pres. only)

Attest: (Corporation)

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

Title: \_\_\_\_\_  
(Corp. Sec. or Asst. Sec. only)

The State of North Carolina through\*

(CORPORATE SEAL)

\_\_\_\_\_  
(Agency, Department or Institution)

Witness:

\_\_\_\_\_

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

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

**FORM OF PERFORMANCE BOND**

Date of Contract: \_\_\_\_\_

Date of Execution: \_\_\_\_\_

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

Name of Surety: \_\_\_\_\_

Name of Contracting  
Body: \_\_\_\_\_

Amount of Bond: \_\_\_\_\_

Project

KNOW ALL MEN BY THESE PRESENTS, that we, the principal and surety above named, are held and firmly bound unto the above named contracting body, hereinafter called the contracting body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind, ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal entered into a certain contract with the contracting body, identified as shown above and hereto attached:

NOW, THEREFORE, if the principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the contracting body, with or without notice to the surety, and during the life of any guaranty required under the contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the surety being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue.

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

Executed in \_\_\_\_\_ counterparts.

Witness:

\_\_\_\_\_  
(Proprietorship or Partnership)

Attest: (Corporation)

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

Title: \_\_\_\_\_  
(Corp. Sec. or Asst. Sec. only)

(Corporate Seal)

\_\_\_\_\_  
Contractor: (Trade or Corporate Name)

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

Title: \_\_\_\_\_  
(Owner, Partner, or Corp. Pres. or Vice Pres. only)

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

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

Title: \_\_\_\_\_  
(Attorney in Fact)

(Surety Corporate Seal)

Witness:

\_\_\_\_\_

Countersigned:

\_\_\_\_\_

\_\_\_\_\_  
(N.C. Licensed Resident Agent)

\_\_\_\_\_

\_\_\_\_\_  
Name and Address-Surety Agency

\_\_\_\_\_

\_\_\_\_\_  
Surety Company Name and N.C.  
Regional or Branch Office Address

**FORM OF PAYMENT BOND**

Date of Contract: \_\_\_\_\_

Date of Execution: \_\_\_\_\_

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

Name of Surety: \_\_\_\_\_

Name of Contracting  
Body: \_\_\_\_\_

Amount of Bond: \_\_\_\_\_

Project \_\_\_\_\_

KNOW ALL MEN BY THESE PRESENTS, that we, the principal and surety above named, are held and firmly bound unto the above named contracting body, hereinafter called the contracting body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal entered into a certain contract with the contracting body identified as shown above and hereto attached:

NOW, THEREFORE, if the principal shall promptly make payment to all persons supplying labor/material in the prosecution of the work provided for in said contract, and any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the surety being hereby waived, then this obligation to be void; otherwise to remain in full force and virtue.

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

Executed in \_\_\_\_\_ counterparts.

Witness:

\_\_\_\_\_  
(Proprietorship or Partnership)

Attest: (Corporation)

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

Title: \_\_\_\_\_  
(Corp. Sec. or Asst. Sec.. only)

(Corporate Seal)

Witness:

\_\_\_\_\_

Countersigned:

\_\_\_\_\_

\_\_\_\_\_  
(N.C. Licensed Resident Agent)

\_\_\_\_\_

\_\_\_\_\_  
Name and Address-Surety Agency

\_\_\_\_\_

\_\_\_\_\_  
Surety Company Name and N.C.  
Regional or Branch Office Address

\_\_\_\_\_  
Contractor: (Trade or Corporate Name)

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

Title \_\_\_\_\_  
(Owner, Partner, or Corp. Pres. or Vice  
Pres. only)

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

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

Title: \_\_\_\_\_  
(Attorney in Fact)

(Surety Corporate Seal)



# Sheet for Attaching Power of Attorney

# Sheet for Attaching Insurance Certificates

# APPROVAL OF THE ATTORNEY GENERAL

**CERTIFICATION BY THE OFFICE OF STATE  
BUDGET AND MANAGEMENT**

Provision for the payment of money to fall due and payable by the

---

under this agreement has been provided for by allocation made and is available for the purpose of carrying out this agreement.

This \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_.

Signed \_\_\_\_\_  
Budget Officer

STATE OF NORTH CAROLINA  
 COUNTY SALES AND USE TAX REPORT  
 SUMMARY TOTALS AND CERTIFICATION

CONTRACTOR: \_\_\_\_\_ Page 1 of \_\_\_\_\_

PROJECT: \_\_\_\_\_ FOR PERIOD: \_\_\_\_\_

	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL ALL COUNTIES
CONTRACTOR						
SUBCONTRACTOR(S)*						
COUNTY TOTAL						

\* Attach subcontractor(s) report(s)  
 \*\* Must balance with Detail Sheet(s)

I certify that the above figures do not include any tax paid on supplies, tools and equipment which were used to perform this contract and only includes those building materials, supplies, fixtures and equipment which actually became a part of or annexed to the building or structure. I certify that, to the best of my knowledge, the information provided here is true, correct, and complete.

Sworn to and subscribed before me,

This the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_  
 \_\_\_\_\_ Signed

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

My Commission Expires: \_\_\_\_\_  
 \_\_\_\_\_ Print or Type Name of Above

Seal  
 NOTE:  
 This certified statement may be subject to audit.





# State of North Carolina AFFIDAVIT A – Listing of Good Faith Efforts

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

(Name of Bidder)

Affidavit of \_\_\_\_\_

I have made a good faith effort to comply under the following areas checked:

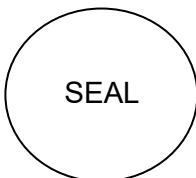
**Bidders must earn at least 50 points from the good faith efforts listed for their bid to be considered responsive.** (1 NC Administrative Code 30 I.0101)

- 1 – (10 pts)** Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed.
- 2 --(10 pts)** Made the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bids are due.
- 3 – (15 pts)** Broken down or combined elements of work into economically feasible units to facilitate minority participation.
- 4 – (10 pts)** Worked with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- 5 – (10 pts)** Attended prebid meetings scheduled by the public owner.
- 6 – (20 pts)** Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.
- 7 – (15 pts)** Negotiated in good faith with interested minority businesses and did not reject them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- 8 – (25 pts)** Provided assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisted minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- 9 – (20 pts)** Negotiated joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- 10 - (20 pts)** Provided quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

The undersigned, if apparent low bidder, will enter into a formal agreement with the firms listed in the Identification of Minority Business Participation schedule conditional upon scope of contract to be executed with the Owner. Substitution of contractors must be in accordance with GS143-128.2(d) Failure to abide by this statutory provision will constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of the minority business commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: \_\_\_\_\_ Name of Authorized Officer: \_\_\_\_\_  
Signature: \_\_\_\_\_  
Title: \_\_\_\_\_



State of \_\_\_\_\_, County of \_\_\_\_\_  
Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_  
Notary Public \_\_\_\_\_  
My commission expires \_\_\_\_\_



# State of North Carolina --AFFIDAVIT B-- Intent to Perform Contract with Own Workforce.

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

Affidavit of \_\_\_\_\_  
(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for the \_\_\_\_\_ contract.  
(Name of Project)

In making this certification, the Bidder states that the Bidder does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform all elements of the work on this project with his/her own current work forces; and

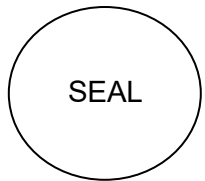
The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement. The Bidder agrees to make a Good Faith Effort to utilize minority suppliers where possible.

The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date: \_\_\_\_\_ Name of Authorized Officer: \_\_\_\_\_

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

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



State of \_\_\_\_\_, County of \_\_\_\_\_

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

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

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

# State of North Carolina - AFFIDAVIT C - Portion of the Work to be Performed by HUB Certified/Minority Businesses

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

**(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)**

If the portion of the work to be executed by HUB certified/minority businesses as defined in GS143-128.2(g) and 128.4(a),(b),(e) is equal to or greater than 10% of the bidders total contract price, then the bidder must complete this affidavit.  
 This affidavit shall be provided by the apparent lowest responsible, responsive bidder within **72 hours** after notification of being low bidder.

Affidavit of \_\_\_\_\_ I do hereby certify that on the \_\_\_\_\_  
 (Name of Bidder)

\_\_\_\_\_ (Project Name)  
 Project ID# \_\_\_\_\_ Amount of Bid \$ \_\_\_\_\_

I will expend a minimum of \_\_\_\_\_% of the total dollar amount of the contract with minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. Attach additional sheets if required

Name and Phone Number	*Minority Category	**HUB Certified Y/N	Work Description	Dollar Value

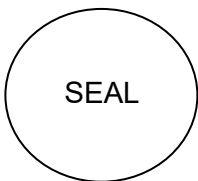
\*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**\*\* HUB Certification with the state HUB Office required to be counted toward state participation goals.**

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: \_\_\_\_\_ Name of Authorized Officer: \_\_\_\_\_



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

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

State of \_\_\_\_\_, County of \_\_\_\_\_

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

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

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

# State of North Carolina AFFIDAVIT D – Good Faith Efforts

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

**(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)**

If the goal of 10% participation by HUB Certified/ minority business **is not** achieved, the Bidder shall provide the following documentation to the Owner of his good faith efforts:

Affidavit of \_\_\_\_\_ I do hereby certify that on the \_\_\_\_\_  
(Name of Bidder)

Project ID# \_\_\_\_\_ (Project Name) Amount of Bid \$ \_\_\_\_\_

I will expend a minimum of \_\_\_\_\_% of the total dollar amount of the contract with HUB certified/ minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. (Attach additional sheets if required)

Name and Phone Number	*Minority Category	**HUB Certified Y/N	Work Description	Dollar Value

\*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**\*\* HUB Certification with the state HUB Office required to be counted toward state participation goals.**

Examples of documentation that may be required to demonstrate the Bidder's good faith efforts to meet the goals set forth in these provisions include, but are not necessarily limited to, the following:

- A. Copies of solicitations for quotes to at least three (3) minority business firms from the source list provided by the State for each subcontract to be let under this contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date and time when quotes must be received.
- B. Copies of quotes or responses received from each firm responding to the solicitation.
- C. A telephone log of follow-up calls to each firm sent a solicitation.
- D. For subcontracts where a minority business firm is not considered the lowest responsible sub-bidder, copies of quotes received from all firms submitting quotes for that particular subcontract.
- E. Documentation of any contacts or correspondence to minority business, community, or contractor organizations in an attempt to meet the goal.
- F. Copy of pre-bid roster
- G. Letter documenting efforts to provide assistance in obtaining required bonding or insurance for minority business.
- H. Letter detailing reasons for rejection of minority business due to lack of qualification.
- I. Letter documenting proposed assistance offered to minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

Failure to provide the documentation as listed in these provisions may result in rejection of the bid and award to the next lowest responsible and responsive bidder.

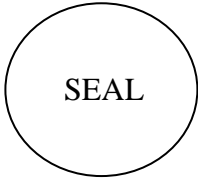
Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: \_\_\_\_\_ Name of Authorized Officer: \_\_\_\_\_

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

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



State of \_\_\_\_\_, County of \_\_\_\_\_

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

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

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

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# NOTICE TO BIDDERS

Sealed proposals will be received by the **Western Carolina University** in **Cullowhee, NC**, in the **Facilities Management Offices** located at **3476 Old Cullowhee Rd, Cullowhee, NC 28723** up to **3:00 pm, December 9<sup>th</sup>, 2021**, and immediately thereafter publicly opened and read for the furnishing of labor, material and equipment entering into the construction of:

## **Stillwell Building Backfill Renovations**

Selective exterior and interior renovation of Stillwell Science building offices, classrooms, and labs. Bids will be received for single prime. All proposals shall be lump sum.

### **Pre-Bid Meeting**

An open pre-bid meeting will be held for all interested bidders on **Thursday, November 18, 2021**, at **2:00 pm** at **WCU Facilities Management Offices**. The meeting will address project specific questions, issues, bidding procedures and bid forms.

*(Delete the following section if preferred brand alternates are NOT being considered.)*

*The meeting is also to identify preferred brand alternates and their performance standards that the owner will consider for approval on this project. In accordance with General Statute GS 133-3, Specifications may list one or more preferred brands as an alternate to the base bid in limited circumstances. Specifications containing a preferred brand alternate under this section must identify the performance standards that support the preference. Performance standards for the preference must be approved in advance by the owner in an open meeting. Any alternate approved by the owner shall be approved only where (i) the preferred alternate will provide cost savings, maintain, or improve the functioning of any process or system affected by the preferred item or items, or both, and (ii) a justification identifying these criteria is made available in writing to the public.*

*In accordance with GS133-3 and SCO procedures the following preferred brand items are being considered as Alternates by the owner for this project:*

#### *A. Da-Lite Idea writeable, erasable projection surface*

*Justification of any approvals will be made available to the public in writing no later than seven (7) days prior to bid date.*

Complete plans and specification for this project can be examined during normal office hours at PFA Architects, PA, located at 196 Coxe Ave., Asheville, NC 28801. Hours: 8am–5pm Mon-Thur and 8am–12 pm/noon Fri.; as well as at Henco Reprographics after **October 7, 2021**. Masks are required inside of these businesses due to N.C. mandate. Other Plan Rooms will have complete plans, specifications, and contract documents open for inspection at:

- Hispanic Contractors Association of the Carolinas (HCAC) in Winston-Salem, Charlotte, and Raleigh Areas (877-227-1680)
- Metrolina Minority Contractors Association located at 3124 W. Trade Street, Unit A, Charlotte, NC 28202 (P: 704-332-5746 | F: 704-332-5990)
- Construction Market Data (formerly Reed Construction Data) at [www.cmdgroup.com](http://www.cmdgroup.com)

# NOTICE TO BIDDERS

Copies of the Contract Documents may be obtained by those qualified as prime bidders, upon deposit of cash or certified check or purchase price, after **October 7, 2021**, directly from:

## Henco Reprographics

Website: [www.hencoplanroom.com](http://www.hencoplanroom.com)

54 Broadway, Asheville, NC 28801

Phone: 828-253-0449

Hours of Business: M-F 8am- 5:30pm

Hard Copies: **Refundable Plan Deposit of \$250.00**

Digital Copies: **Non-Refundable Purchase Price of \$100.00**

Refundable plan deposits will be returned to those bidders provided all documents are returned in good, usable condition within ten (10) days after the bid date.

If a contractor is bidding under the dual system both as a single prime contractor and as a separate prime contractor, he must submit the bids on separate forms and in separate envelopes. Bidders should clearly indicate on the outside of the bid envelope which contract(s) they are bidding.

**NOTE:** The bidder shall include with the bid proposal the form *Identification of Minority Business Participation* identifying the minority business participation it will use on the project and shall include either *Affidavit A* or *Affidavit B* as applicable. Forms and instructions are included within the Proposal Form in the bid documents. Failure to complete these forms is grounds for rejection of the bid. (GS143-128.2c Effective 1/1/2002.)

All contractors are hereby notified that they must have proper license as required under the state laws governing their respective trades.

General contractors are notified that Chapter 87, Article 1, General Statutes of North Carolina, will be observed in receiving and awarding general contracts. General contractors submitting bids on this project must have license classification for Unlimited License

**NOTE--SINGLE PRIME CONTRACTS:** Under GS 87-1, a contractor that superintends or manages construction of any building, highway, public utility, grading, structure, or improvement shall be deemed a "general contractor" and shall be so licensed. Therefore, a single prime project that involves other trades will require the single prime contractor to hold a proper General Contractors license. **EXCEPT:** On public buildings being bid single prime, where the total value of the general construction does not exceed 25% of the total construction value, contractors under GS87- Arts 2 and 4 (Plumbing, Mechanical & Electrical) may bid and contract directly with the Owner as the SINGLE PRIME CONTRACTOR and may subcontract to other properly licensed trades. [GS87-1.1- Rules .0210](#)

Each proposal shall be accompanied by a cash deposit or a certified check drawn on some bank or trust company, insured by the Federal Deposit Insurance Corporation, of an amount equal to not less than five percent (5%) of the proposal, or in lieu thereof a bidder may offer a bid bond of five percent (5%) of the bid executed by a surety company licensed under the laws of North Carolina to execute the contract in accordance with the bid bond. Said deposit shall be retained by the owner as liquidated damages in event of failure of the successful bidder to execute the contract within ten days after the award or to give satisfactory surety as required by law.

# NOTICE TO BIDDERS

A performance bond and a payment bond will be required for one hundred percent (100%) of the contract price.

Payment will be made based on ninety-five percent (95%) of monthly estimates and final payment made upon completion and acceptance of work.

No bid may be withdrawn after the scheduled closing time for the receipt of bids for a period of 30 days.

The owner reserves the right to reject any or all bids and to waive informalities.

**Designer:** Lord Aeck Sargent, Inc.

1450 Raleigh Rd, Ste 109

Chapel Hill NC 27517

877-929-1400

**Owner:** Western Carolina University

3476 Old Cullowhee Rd.,

Cullowhee, NC 28723

828-227-7224



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# FORM OF PROPOSAL

Stillwell Building Backfill Project

Contract: \_\_\_\_\_

Western Carolina University

Bidder: \_\_\_\_\_

SCO# - 16-15506-04D

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

The undersigned, as bidder, hereby declares that the only person or persons interested in this proposal as principal or principals is or are named herein and that no other person than herein mentioned has any interest in this proposal or in the contract to be entered into; that this proposal is made without connection with any other person, company or parties making a bid or proposal; and that it is in all respects fair and in good faith without collusion or fraud. The bidder further declares that he has examined the site of the work and the contract documents relative thereto, and has read all special provisions furnished prior to the opening of bids; that he has satisfied himself relative to the work to be performed. The bidder further declares that he and his subcontractors have fully complied with NCGS 64, Article 2 in regards to E-Verification as required by Section 2.(c) of Session Law 2013-418, codified as N.C. Gen. Stat. § 143-129(j).

The Bidder proposes and agrees if this proposal is accepted to contract with the

State of North Carolina through the Western Carolina University

in the form of contract specified below, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary to complete the construction of

Stillwell Building Backfill Project

in full in complete accordance with the plans, specifications and contract documents, to the full and entire satisfaction of the State of North Carolina, and the

Western Carolina University

with a definite understanding that no money will be allowed for extra work except as set forth in the General Conditions and the contract documents, for the sum of:

## **SINGLE PRIME CONTRACT:**

Base Bid:

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

General Subcontractor:

Plumbing Subcontractor:

\_\_\_\_\_ Lic \_\_\_\_\_

\_\_\_\_\_ Lic \_\_\_\_\_

Mechanical Subcontractor:

Electrical Subcontractor:

\_\_\_\_\_ Lic \_\_\_\_\_

\_\_\_\_\_ Lic \_\_\_\_\_

GS143-128(d) requires all single prime bidders to identify their subcontractors for the above subdivisions of work. A contractor whose bid is accepted shall not substitute any person as subcontractor in the place of the subcontractor listed in the original bid, except (i) if the listed subcontractor's bid is later determined by the contractor to be non-responsible or non-responsive or the listed subcontractor refuses to enter into a contract for the complete performance of the bid work, or (ii) with the approval of the awarding authority for good cause shown by the contractor.

## **ALTERNATES:**

Should any of the alternates as described in the contract documents be accepted, the amount written below shall be the amount to be "added to" or "deducted from" the base bid. (Strike out "Add" or "Deduct" as appropriate.)

**GENERAL CONTRACT:**

Alternate No. 1 Owner preferred alternate for Da-Lite Idea writeable/eraseable projection surface.

Add (Deduct) \_\_\_\_\_ Dollars(\$) \_\_\_\_\_

**UNIT PRICES**

Unit prices quoted and accepted shall apply throughout the life of the contract, except as otherwise specifically noted. Unit prices shall be applied, as appropriate, to compute the total value of changes in the base bid quantity of the work all in accordance with the contract documents.

**GENERAL CONTRACT:**

No. 1 N/A \_\_\_\_\_ (Unit) \_\_\_\_\_ Unit Price (\$) \_\_\_\_\_

The bidder further proposes and agrees hereby to commence work under this contract on a date to be specified in a written order of the designer and shall fully complete all work thereunder within the time specified in the Supplementary General Conditions Article 23. Applicable liquidated damages amount is also stated in the Supplementary General Conditions Article 23.

**MINORITY BUSINESS PARTICIPATION REQUIREMENTS**

Provide with the bid - Under GS 143-128.2(c) the undersigned bidder shall identify **on its bid** (Identification of Minority Business Participation Form) the minority businesses that it will use on the project with the total dollar value of the bids that will be performed by the minority businesses. **Also** list the good faith efforts (Affidavit **A**) made to solicit minority participation in the bid effort.

**NOTE:** A contractor that performs all of the work with its own workforce may submit an Affidavit (**B**) to that effect in lieu of Affidavit (**A**) required above. The MB Participation Form must still be submitted even if there is zero participation.

After the bid opening - The Owner will consider all bids and alternates and determine the lowest responsible, responsive bidder. Upon notification of being the apparent low bidder, the bidder shall then file within 72 hours of the notification of being the apparent lowest bidder, the following:

An Affidavit (**C**) that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the 10% goal established. This affidavit shall give rise to the presumption that the bidder has made the required good faith effort and Affidavit **D** is not necessary;

\* **OR** \*

If less than the 10% goal, Affidavit (**D**) of its good faith effort to meet the goal shall be provided. The document must include evidence of all good faith efforts that were implemented, including any advertisements, solicitations and other specific actions demonstrating recruitment and selection of minority businesses for participation in the contract.

**Note:** Bidders must always submit **with their bid** the Identification of Minority Business Participation Form listing all MB contractors, vendors and suppliers that will be used. If there is no MB participation, then enter none or zero on the form. Affidavit **A** or Affidavit **B**, as applicable, also must be submitted with the bid. Failure to file a required affidavit or documentation with the bid or after being notified apparent low bidder is grounds for rejection of the bid.

# Proposal Signature Page

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The undersigned further agrees that in the case of failure on his part to execute the said contract and the bonds within ten (10) consecutive calendar days after being given written notice of the award of contract, the certified check, cash or bid bond accompanying this bid shall be paid into the funds of the owner's account set aside for the project, as liquidated damages for such failure; otherwise the certified check, cash or bid bond accompanying this proposal shall be returned to the undersigned.

Respectfully submitted this day of \_\_\_\_\_

\_\_\_\_\_  
(Name of firm or corporation making bid)

WITNESS:

\_\_\_\_\_  
(Proprietorship or Partnership)

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

Name: \_\_\_\_\_  
Print or type

Title \_\_\_\_\_  
(Owner/Partner/Pres./V.Pres)

Address \_\_\_\_\_

ATTEST:

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

Title: \_\_\_\_\_  
(Corp. Sec. or Asst. Sec. only)

License No. \_\_\_\_\_

Federal I.D. No. \_\_\_\_\_

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

(CORPORATE SEAL)

Addendum received and used in computing bid:

Addendum No. 1 \_\_\_\_\_ Addendum No. 3 \_\_\_\_\_ Addendum No. 5 \_\_\_\_\_ Addendum No. 6 \_\_\_\_\_

Addendum No. 2 \_\_\_\_\_ Addendum No. 4 \_\_\_\_\_ Addendum No. 6 \_\_\_\_\_ Addendum No. 7 \_\_\_\_\_

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SECTION 00 30 00 - INFORMATION AVAILABLE TO BIDDERS

EXISTING REPORTS AND SURVEYS

1.01 DRAWINGS OF EXISTING BUILDINGS

- A. While preparing the Contract Documents, the Architect has relied upon the following drawings of the existing building:
1. Sheets 023510-A000a.dwg through 023510-A705.dwg;
  2. Sheets 023510-S101 through 023510-S501;
  3. Sheets 023510-P001 through 023510-P601;
  4. Sheets 023510-M001 through 023510-M505;
  5. Sheets 023510-E001 through 023510-E604;
  6. Sheets 023510-FP001 through 023510-FP203;
  7. Flow Test
- B. Copies of these drawings are available upon request from the Architect. They are not part of the Contract Documents, but the Contractor is entitled to rely upon the general accuracy of these drawings except for the completeness of these drawings, interpretations contained in these drawings, and the quantity, size, and actual routing of mechanical, electrical, and plumbing items indicated in these drawings. The Contractor shall make no claim against the Owner or Architect's consultants on the basis of the Contractor's interpretations of or conclusions drawn from these drawings, the completeness of these drawings, interpretations contained in these drawings, or the quantity, size, or actual routing of mechanical, electrical, or plumbing items indicated in these drawings.

END OF SECTION

<b>FIRE HYDRANTS 2020</b>				
<b>Hyd. #</b>	<b>Pitot</b>	<b>Flow Rate</b>	<b>Location</b>	
	<b>PSI</b>	<b>GPM</b>		
1	60	1300	East Side of Warehouse	
3	50	1190	North Side of Warehouse	
5	65	1350	North Side Of Water Plant	
7	75	1455	N. W. Side of Facilities	
9	40	1060	East Side Of Robertson Parking Lot	
11	40	1060	West Side Of Robertson Parking Lot	
13	45	1130	North Side o Robertson Building	
15	40	1060	NW Side of	
17	35	1000	NW Side of Reynolds	
19	60	1300	South Side of Madison	
21	O/S		South Side of Grounds Shop	
23	30	920	NE Side of Old Student Union	
25	40	1060	Bird Lane	
27	30	920	West Side of Moore	
29	50	1190	Off Bank West Side of Moore	
31	50	1190	SW Side of Judaculla	
33	40	1060	Roundabout At Allen	
35	85	1550	NW of Harrill	
37	60	1300	NE of Harrill	
39	65	1350	NW of Allen	
41	75	1455	East Side of Benton	
43	70	1405	East Side of Albright	
45	50	1190	East Side of Brown	
47	85	1550	West Side of Brown Near Road	
49	20	750	Steam Plant	
51	25	850	Loading Dock At Hunter	
53	20	530	NE of Hunter	
55	O/S		Between Hunter and Stem Bldg.	In Construction
57	O/S		West Side of Stem	In Construction
59	60	1300	Front Of Univ. Auditorium (Hoey)	
61	80	1500	South Side of Mckee	
63	75	1405	Trash Compactor at Chili's	
65	75	1455	North Side of Noble	
67	65	1350	South Side of Noble	
69	80	1500	South of Forsyth	
71	45	110	SE of Reid	
73	70	1405	North Side Killian	
75	60	1300	NW Killian	
77	85	1560	West Side Killian	
79	70	1405	Loading Dock at Univ. Ctr.	
81	80	1500	East Side of Bookstore	

83	70	1405	NW of Rec. Ctr.	
85	80	1500	North Side of Bookstore	
87	90	1590	South Side of Print Shop	
89	55	1250	Before Curve on Norton Rd.	
91	60	1300	Cat Tran Stop on Norton Rd.	
93	50	1190	East Side of Norton Hall	
95	50	1190	Village Commons	
97	45	1130	West Side of Village MOB (1100-1600)	
99	50	1190	West of Village 2100	
101	60	1300	SW Ramsey	
103	60	1300	NE Ramsey	
105	50	1190	Ticket Booth West Side Stadium	
107	80	1500	NE Field House	
109	75	1455	SE Belk	
111	130	1725	West Side CAT Bldg,	
113	70	1405	SW of Balsam	
115	90	1590	SE Blue Ridge	
117	100	1680	East Side of Bardo Arts Ctr.	
119	85	1525	NE Bardo Arts Ctr. By Steam Bldg.	
121	90	1590	West Side of Dining Hall	
123	O/S		Scott	To Be Demo'd
125	O/S		Scott	To Be Demo'd
127	O/S		Walker	To Be Demo'd
129	70	1405	SW H.F. Robinson	
131	90	1590	NE Camp Lab	
133	60	1300	East Camp Lab	
135	60	1300	Camp Lab Gym	
137	60	1300	West Camp Lab by Campus PD	
139	60	1300	Track Complex	
141	40	1060	Near Softball Complex	
143	40	1060	NCCAT	
145	20	650	West Side NCCAT	
8/21/2020				





SECTION 01 10 00 - SUMMARY

PART 1 GENERAL

1.01 REMOVALS

- A. Owner will remove the following items before start of work:
  - 1. Overhead projectors..

1.02 WORK BY OWNER

- A. Items noted OFCI (Owner Furnished, Contractor Installed) will be supplied by Owner and installed by Contractor.

1.03 OWNER OCCUPANCY

- A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work to accommodate Owner occupancy.

1.04 CONTRACTOR USE OF SITE

- A. Construction Operations: Limited to areas noted on Drawings.
- B. Arrange use of site and premises to allow:
  - 1. Owner occupancy.
  - 2. Work by Owner or by others.
- C. Provide access to and from site as required by law and by Owner.
- D. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
- E. Do not obstruct roadways, sidewalks, or other public ways without permit.
- F. Existing building spaces may be used for storage only if agreed to by Owner one (1) month in advance of use and spaces must be vacated on the date agreed to by the Owner.
- G. Utility Outages and Shutdown:
  - 1. Limit disruption of utility services to hours when the building is unoccupied and when approved by the Owner.
  - 2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without notice to and approval from the Owner. Secure the approval of authorities having jurisdiction when required.
  - 3. Prevent accidental disruption of utility services to other facilities.

1.05 WORK SEQUENCE

- A. Coordinate construction schedule and operations with Owner.
- B. Coordinate construction schedule and operations with Architect.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION



SECTION 01 20 00 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of proposed changes in Contract Sum and Contract Time.

1.02 SCHEDULE OF VALUES

- A. Submit a printed schedule that accurately reflects the fair market value of the several portions of the work in a form acceptable to the Architect.
- B. Submit a printed schedule showing each item of work and using the Table of Contents of this Project Manual as a guide. Identify each line item with number and title of the specification Section, breaking down individual sections into discrete items of work to facilitate evaluation of completion.
- C. Include the amount of each Allowance provided in the Contract Documents.
- D. For unit price work, identify quantities taken from the Contract Documents multiplied by the Contract unit price to achieve the total for the item.
- E. Revise schedule to list approved Change Orders, with each Application For Payment.

1.03 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Present required information in typewritten form.
- C. Form: AIA G702 Application and Certificate for Payment plus either AIA G703 Continuation Sheet or Contractor's electronic media driven form as continuation sheet.
- D. Execute certification by signature of authorized officer.
- E. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.
- F. Submit three copies of each Application for Payment.
- G. If off-site storage is permitted by the General Conditions and is agreed to by the Owner, provide affidavits in a form acceptable to the Owner attesting to off-site stored products.
- H. When Architect requires substantiating information, submit data justifying dollar amounts in question.

1.04 SUBSTANTIATION OF COST OF PROPOSED CONTRACT MODIFICATIONS

- A. Provide full information required for evaluation:
  - 1. Quantities of materials and the cost thereof including shipping to the site.
  - 2. Manhours of labor and hourly cost including payroll taxes, insurance, and benefits for each skill or labor classification.
  - 3. Quantities and costs of equipment, tools, and other material not incorporated into the work.
  - 4. Overhead and profit.
  - 5. Justification for any change in Contract Time.
  - 6. Credit for deletions from Contract, similarly documented.
  - 7. Other information requested by the Architect.
- B. For Time and Material work, submit itemized account and supporting data as the work progresses and after completion of change, within time limits indicated in the Conditions of the Contract.

END OF SECTION



SECTION 01 22 00 - UNIT PRICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. List of unit prices, for use in preparing Bids.
- B. Measurement and payment criteria applicable to Work performed under a unit price payment method.

1.02 COSTS INCLUDED

- A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.03 UNIT QUANTITIES SPECIFIED

- A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.04 MEASUREMENT OF QUANTITIES

- A. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.
- B. Take all measurements and compute quantities. Measurements and quantities will be verified by Owner.
- C. Assist by providing necessary equipment, workers, and survey personnel as required.
- D. Perform surveys required to determine quantities, including control surveys to establish measurement reference lines. Notify Architect prior to starting work.
- E. Contractor's Engineer Responsibilities: Sign surveyor's field notes or keep duplicate field notes, calculate and certify quantities for payment purposes.

1.05 PAYMENT

- A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.
- B. Payment will not be made for any of the following:
  - 1. Products wasted or disposed of in a manner that is not acceptable.
  - 2. Products determined as unacceptable before or after placement.
  - 3. Products not completely unloaded from the transporting vehicle.
  - 4. Products placed beyond the lines and levels of the required Work.
  - 5. Products remaining on hand after completion of the Work.
  - 6. Loading, hauling, and disposing of rejected Products.

1.06 SCHEDULE OF UNIT PRICES

- A. Moisture-Resistant Sealer-Surfacer.
  - 1. Section 09 0561 - Preparation of Concrete to Receive Adhesively Installed Flooring.
  - 2. Measurement: Plan quantity, work in place.
  - 3. Payment: Per square foot.
  - 4. Include the following quantity in the Base Bid: 0 SF.
- B. Standard Flooring Adhesive for Resilient Flooring.
  - 1. Section 09 6500 - Resilient Flooring.
  - 2. Section 09 0561 - Preparation of Concrete to Receive Adhesively Installed Flooring.
  - 3. Measurement: Plan quantity, work in place.
  - 4. Payment: Per square foot.

5. Include the following quantity in the Base Bid: 100% of the area to receive resilient flooring.
- C. Moisture-Resistant Flooring Adhesive for Resilient Flooring.
1. Section 09 6500 - Resilient Flooring.
  2. Section 09 0561 - Preparation of Concrete to Receive Adhesively Installed Flooring.
  3. Measurement: Plan quantity, work in place.
  4. Payment: Per square foot.
  5. Include the following quantity in the Base Bid: 0 SF.
- D. Standard Flooring Adhesive for Carpet.
1. Section 09 6800 - Carpet.
  2. Section 09 0561 - Preparation of Concrete to Receive Adhesively Installed Flooring.
  3. Measurement: Plan quantity, work in place.
  4. Payment: Per square foot.
  5. Include the following quantity in the Base Bid: 100% of the area to receive carpet.
- E. Moisture-Resistant Flooring Adhesive for Carpet.
1. Section 09 6800 - Carpet.
  2. Section 09 0561 - Preparation of Concrete to Receive Adhesively Installed Flooring.
  3. Measurement: Plan quantity, work in place.
  4. Payment: Per square foot.
  5. Include the following quantity in the Base Bid: 0 SF.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 23 00 - ALTERNATES

PART 1 GENERAL

1.01 ACCEPTANCE OF ALTERNATES

- A. Alternatives quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted alternatives will be identified in the Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work to integrate the Work of each alternative.

1.02 SCHEDULE OF ALTERNATES

- A. Owner Preferred Alternate No. 1 -- Da-Lite Idea Eraseable Projection Surface
  - 1. Writeable and eraseable projection surface - Refer to 10 11 46.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION





SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preconstruction meeting.
- B. Progress meetings.
- C. Progress photographs.

1.02 ELECTRONIC DELIVERY OF PROJECT CORRESPONDENCE

- A. Unless otherwise required or permitted, deliver project correspondence and documentation to the Architect in electronic form via "Newforma Info Exchange" provided by the Architect at no cost to the Contractor.
- B. Unless otherwise required or permitted, employ pdf format and create pdf documents using standard text/graphic conversion software such as Adobe or Bluebeam and employ bookmarks throughout the document for ease of navigation; manually scanned documents are not acceptable.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

- A. Architect will schedule a meeting at the Project site prior to Contractor occupancy.
- B. Attendance Required:
  - 1. Contractor.
  - 2. Owner.
  - 3. Architect.
  - 4. Contractor's Superintendent.
- C. Agenda:
  - 1. Preliminary Contract Matters.
    - a. Bonds, insurance certificates, and other preliminary contract compliance submittals.
    - b. Notice to proceed.
    - c. Schedule of values.
    - d. Construction progress schedule.
    - e. Weather delays
    - f. Change Orders
    - g. Construction Site Decorum
    - h. Liquidated Damages
    - i. Submittal schedule.
    - j. List of subcontractors.
    - k. List of products.
    - l. Posted construction documents (including addenda).
    - m. Mobilization.
    - n. Use of premises by Owner.
  - 2. Project Correspondence.
    - a. Meeting notes.
    - b. Architect's Field Reports.
    - c. Requests for Information.
    - d. Submittals (product data, shop drawings, test reports, etc.).
    - e. Product substitutions.
    - f. Procedures for processing of ASI, PR, CCD, CO.

- g. Substantiation of proposed cost of contract modifications and substitution requests.
- h. Applications for Payment.
- 3. Site.
  - a. Temporary Utilities.
  - b. Temporary facilities and services.
  - c. Staging/storage.
  - d. Contractor parking.
  - e. Owner Requirements (Badging, Housekeeping).
  - f. Testing Procedures.
  - g. Severe Weather Rules.
  - h. Security and housekeeping.
  - i. Waste removal and disposal.
- 4. Post Construction.
  - a. Owner's requirements and occupancy prior to completion.
  - b. Project close out procedures.
  - c. Start-up, training, and O&M manuals.
  - d. Inspection and acceptance of equipment put into service during construction period.
  - e. Maintaining record documents.
  - f. Releases (surety, waivers, etc.).
  - g. Reducing retainage.
  - h. Inspection for Substantial Completion, Date of Substantial Completion, Final Completion, Final Payment.
  - i. 11-Month Warranty Review.
  - j. Post-Contract Evaluation.

D. Architect will record minutes and distribute copies to Contractor and Owner.

### 3.02 PROGRESS MEETINGS

- A. Progress meetings will be held at monthly intervals.
- B. Architect will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Architect, as appropriate to agenda topics for each meeting.
- D. Agenda:
  - 1. Review minutes of previous meetings.
  - 2. Change Order Log.
    - a. Effect of proposed changes on progress schedule and coordination.
  - 3. Condemnation Log.
  - 4. Quality Issues.
    - a. Field observations, problems, and decisions.
  - 5. Review of Work progress.
  - 6. RFI Log.
  - 7. Review of submittals schedule and status of submittals.
  - 8. Review construction progress schedule.
    - a. Planned progress during succeeding work period.
    - b. Review of off-site fabrication and delivery schedules.
    - c. Time Extension Requests (if any).
    - d. Corrective measures to regain projected schedules.
  - 9. Payment or Claim Issues.
  - 10. Subcontractor Issues.
  - 11. Contractor Application for Payment.
  - 12. Identification of problems which impede planned progress.
  - 13. Other issues Affecting the Work.
    - a. Owner-Provided items (FFE); especially submittal or coordination data.

14. Scheduled pre-installation meetings.
15. Scheduled mock-ups.
16. Scheduled tests.
17. Any other items for discussion.
18. Is the Contractor being delayed because of any action or non-action by the Architect or Owner.
19. Next Meeting Date.
20. Other business relating to Work.

E. Architect will record minutes and distribute copies to Contractor and Owner.

### 3.03 PROGRESS PHOTOGRAPHS

- A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
- B. Photography Type: Digital; electronic files.
- C. Provide photographs of site and construction throughout progress of Work produced by an experienced photographer, acceptable to Architect.

### 3.04 REQUESTS FOR INFORMATION (RFI)

- A. When additional information concerning the Contract Documents is desired, the Contractor shall make a request to the Architect in the form of an RFI and shall include a detailed written statement that indicates the specific Drawing number or Specification paragraph number in need of clarification and the nature of the clarification requested.
- B. The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed to by the Architect or, in the absence of agreement, with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

### 3.05 FOR REQUESTS FOR SUBSTITUTION, SEE:

- A. Invitation to Bid.
- B. General Conditions of the Contract for Construction.
- C. Section 01 60 00 - Product Requirements.
- D. Section 01 62 01 - Pre-Bid Substitution Request.
- E. Section 01 62 02 - Post-Bid Substitution Request.

### 3.06 FOR SUBMITTAL PROCEDURES, SEE:

- A. Section 01 33 00 - Submittals.

END OF SECTION



## SECTION 01 33 00 - SUBMITTAL PROCEDURES

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Procedural requirements for submittals for review, information, and project closeout.
- B. Timing and packaging of submittals.
- C. Delivery of submittals.

#### 1.02 SUBMITTALS

- A. List of proposed major products.
- B. List of proposed subcontractors.
- C. Submittal Schedule

#### 1.03 ELECTRONIC DELIVERY OF PROJECT CORRESPONDENCE

- A. The project will utilize Newforma platform for electronic correspondence. Where electronic delivery of documents is required or permitted, deliver electronic documents via that platform.
- B. Where pdf format is required, create pdf documents using standard text/graphic conversion software such as Adobe or Bluebeam and employ bookmarks throughout the document for ease of navigation; manually scanned documents are not acceptable.

### PART 2 PRODUCTS - NOT USED

### PART 3 EXECUTION

#### 3.01 SUBMITTAL SCHEDULE

- A. Submit a schedule for the major products used on the project. Arrange in chronological order by dates required by the construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

#### 3.02 SHOP DRAWINGS, SUBMITTALS, SAMPLES AND DATA

- A. The GC/CM shall submit with initial approval of the design documents for compliance and accuracy, electronic copies in PDF format of all shop drawings and submittals. Physical samples shall be submitted for color and workmanship (mock-up) approval.
- B. All Shop Drawings, Samples and Submittals for approval shall be completed within thirty (30) days after award of the sub-contract agreement between the GC/CM and the specialty subcontractor.

#### 3.03 SUBMITTALS FOR REVIEW

- A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product. Major products are the primary product(s) specified in each specification section.
  - 1. Submit within 15 days after date of Agreement.
  - 2. For products specified only by reference standards, list applicable reference standards.
- B. Proposed Subcontractors List:
  - 1. Submit list of subcontractors proposed and identify the portion of work assigned to each.
  - 2. Submit installer qualifications specified in respective specification sections.
  - 3. Submit within 15 days after date of Notice to Proceed.
- C. Product Data Submittals: Submit manufacturer's standard published data necessary to demonstrate compliance with specified requirements. Mark each copy to identify applicable

products, models, options, and other data. If necessary, supplement manufacturer's standard data with information specific to this Project.

- D. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- E. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
  - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.
- F. When the following are specified in individual specification sections, submit them for review:
  - 1. Product data.
  - 2. Shop drawings.
  - 3. Samples for selection.
  - 4. Samples for verification.
  - 5. Design data.
  - 6. Manufacturer's instructions.
  - 7. Other types indicated in respective specification sections.
- G. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents. Architect's review is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.
- H. Contractor is responsible for determining and verifying materials, field measurements and field construction criteria related thereto, and checking and coordinating the information contained within the submittal with the requirements of the Work and of the Contract Documents.
- I. Samples will be reviewed only for aesthetic attributes such as color and texture.

### 3.04 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
  - 1. Design data.
  - 2. Certificates.
  - 3. Test reports.
  - 4. Inspection reports.
  - 5. Manufacturer's instructions.
  - 6. Manufacturer's field reports.
  - 7. Other types indicated in respective specification sections.
- B. Submit for Architect's delivery to Owner.
- C. Action taken by the Architect (whether "approval" or other action) indicates only that the item has been received in the form required by the contract documents and that the Architect will transmit the item to the Owner for the Owner's records, but does not indicate that the Architect has verified the accuracy or adequacy of the contents of the submittal.

### 3.05 SUBMITTALS FOR PROJECT CLOSEOUT

- A. When the following are specified in individual sections, submit them at project closeout:
  - 1. Project record documents.
  - 2. Operation and maintenance data.
  - 3. Warranties.
  - 4. Bonds.
  - 5. Other types as indicated.

- B. Submit for Owner's benefit during and after project completion.
- C. Action taken by the Architect (whether "approval" or other action) indicates only that the item has been received in the form required by the contract documents and that the Architect will transmit the item to the Owner for the Owner's records, but does not indicate that the Architect has verified the accuracy or adequacy of the contents of the submittal.

### 3.06 TIMING AND PACKAGING OF SUBMITTALS

- A. Submit complete, coordinated data. Partial submittals are not acceptable unless specifically exempted by the Architect prior to being submitted. For complex assemblies comprising components from two or more Specifications Sections, submit data for all components of the assembly as a single, coordinated package.
- B. Initial Product Information: Submit the initial submittal product information listed below for each Specification Section as a complete, single submittal package utilizing a single submittal tracking number. The submittal shall include all items listed below together as a single submittal with only one submittal tracking number. Partial or incomplete submittals will be rejected due to inadequacy of information to perform a thorough review.
  - 1. Product data.
  - 2. Samples.
  - 3. Installer and manufacturer qualifications.
  - 4. Manufacturer's instructions.
  - 5. Certificates, test reports, and inspection reports of standard plant runs that demonstrate compliance of proposed products with specified quality.
  - 6. Similar submittals demonstrating quality of proposed products.
- C. Shop Drawings and Design Data:
  - 1. Submit Shop Drawings and Design Data for each Section of the Specifications as a single package under one submittal tracking number.
    - a. Exception: When approved by the Architect especially large quantities of drawings on large projects may be divided into individual submissions, such as package 1, 2, 3, etc.
  - 2. Submit the following prior to placing final order for fabrication:
    - a. Detailed drawings prepared specifically for the project, for example drawings of concrete reinforcing, structural steel, curtain wall, equipment.
    - b. Calculations or other designs prepared specifically for the project.
- D. In-Progress Reports: Multiple submittals permitted. Submit the following in a timely manner as the work progresses.
  - 1. Certificates, test reports, and inspection reports of actual plant runs for this project (where required) or of tests and inspections made at the project site (earthwork, concrete, steel, etc.).
  - 2. Similar submittals recording actual quality installed on-site.
- E. Closeout Submittals: Submit the following for each Section of the Specifications as a single package:
  - 1. Final certificates, test reports, and inspection reports of completed work.
  - 2. Project record documents.
  - 3. Operation and maintenance data.
  - 4. Warranties and bonds.
  - 5. Similar submittals attesting to completed work.

### 3.07 DELIVERY OF SUBMITTALS

- A. Initial Product Information, Shop Drawings, Design Data, and In-Progress Reports:
  - 1. Deliver documents electronically in pdf format.
  - 2. Small Size Documents:
    - a. Sheet size either 8-1/2 x 11 or 11 x 17 inches; do not submit 8-1/2 x 14.
  - 3. Documents Larger than 11 x 17 Inches:
    - a. Sheet size as necessary.



- B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect. If not specified in individual specification sections, submit two.
  - 1. Retained samples will not be returned to Contractor unless specifically so stated.
- C. Documents for Information:
  - 1. Deliver documents electronically in pdf format.
- D. Documents for Project Closeout:
  - 1. Warranties, Bonds, and Executed Forms: Submit original (paper) executed documents plus two photocopies.
  - 2. Testing, Balancing, Start-Up, and Operations and Maintenance Manuals:
    - a. Deliver documents electronically in pdf format.
    - b. Submit number of paper copies as specified in respective specification sections. If quantity is not so indicated, submit two copies.
    - c. Submit two copies of CD or DVD-ROM format disks containing pdf files that are indexed and organized by specification section.
- E. Submittal Procedures:
  - 1. Transmit each submittal with approved form.
  - 2. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix representing each revision.
  - 3. Identify Project, Contractor, Subcontractor or supplier. Identify Specification Section number and pertinent drawing and detail number.
  - 4. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
  - 5. Schedule submittals to expedite the Project, and coordinate submission of related items.
  - 6. Schedule submittals for orderly review by the Architect. For each submittal for review, allow 20 days plus delivery time to and from the Contractor, unless Architect notifies Contractor that additional time is necessary for review on account of Contractor's scheduling of simultaneous submittals.
  - 7. Identify variations from the Contract Documents.
  - 8. Identify product or system limitations that in Contractor's view may be detrimental to successful performance of the completed Work.
  - 9. When revised for resubmission, identify all changes made since previous submission.
  - 10. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
  - 11. Submittals not requested will not be processed.

3.08 FOR REQUESTS FOR SUBSTITUTION, SEE:

- A. General Conditions of the Contract for Construction.
- B. Section 01 6000 - Product Requirements.
- C. Section 01 6201 - Pre-Bid Substitution Request.
- D. Section 01 6202 - Post-Bid Substitution Request.

END OF SECTION

## SECTION 01 40 00 - QUALITY REQUIREMENTS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. References and standards.
- B. Mock-ups.
- C. Control of installation.
- D. Tolerances.
- E. Testing and inspection services.
- F. Manufacturer's field services.

#### 1.02 SUBMITTALS

- A. Testing Agency Qualifications:
  - 1. Prior to start of Work, submit agency name, address, and telephone number, and names of full time registered engineer and responsible officer.
  - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
- B. Test Reports: After each test/inspection, promptly submit report directly to Architect and to Contractor. Include:
  - 1. Date issued.
  - 2. Project title and number.
  - 3. Name of inspector.
  - 4. Date and time of sampling or inspection.
  - 5. Identification of product and specifications section.
  - 6. Location in the Project.
  - 7. Type of test/inspection.
  - 8. Date of test/inspection.
  - 9. Results of test/inspection.
  - 10. Conformance with Contract Documents.
  - 11. When requested by Architect, provide interpretation of results.
- C. Manufacturer's Field Reports: Submit reports for Architect's information and benefit as contract administrator.
  - 1. Submit reports within 7 days of observation to Architect.

#### 1.03 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard of date of issue specified in individual specification sections or, if none, the date current on the date of issue of the Contract Documents.
- C. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

#### 1.04 TESTING AND INSPECTION AGENCIES

- A. Owner will employ and pay for services of an independent testing agency to perform specified testing and inspection.

- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. The GC/CM shall provide the Owner a complete list of addresses and emergency telephone numbers for the GC/CM, his key personnel, and all subcontractors. This list shall be provided to the Owner prior to beginning the Work and shall be updated regularly with the updated provided to the Owner.
- C. The GC/CM acknowledges and agrees that, to the best of its knowledge, neither GC/CM nor its employees, representatives or sub-contractors has at any time (1) been charged with personal or professional misconduct; (2) been convicted of any crime (other than traffic fines); (3) been required to register as a sex offender under Title I of the Sex Offender Registration and Notification Act of 2006 (SORNA). GC/CM shall notify Owner immediately should any of the above conditions come into being.
- D. The GC/CM and subcontractors shall verify the work authorization of all employees that work on Western Carolina University property through E-Verify. Such authorization will be made available to Western Carolina University upon request.
- E. Should an accident or disruption occur on the project work site, the GC/CM shall notify Western Carolina University Safety Officer immediately.
- F. Comply with manufacturers' instructions, including each step in sequence.
- G. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- H. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- I. Have Work performed by persons qualified to produce required and specified quality.
- J. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- K. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

### 3.02 MOCK-UPS

- A. Testing may be performed under provisions identified in the respective product specification sections and as otherwise directed by the Architect.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- C. Approved mock-ups (in conjunction with the other requirements of the Contract Documents) shall be a standard of quality for judging the Work.
- D. If mock-up is specified to be removed, remove and dispose of the mock-up only after mock-up has been approved by Architect and when directed to do so.

### 3.03 TOLERANCES

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

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

#### 3.04 TESTING AND INSPECTION

- A. See individual specification sections for testing required.
- B. Testing Agency Duties:
  - 1. Test samples of mixes submitted by Contractor.
  - 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
  - 3. Perform specified sampling and testing of products in accordance with specified standards.
  - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
  - 5. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
  - 6. Perform additional tests and inspections required by Architect.
  - 7. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
  - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
  - 2. Agency may not approve or accept any portion of the Work.
  - 3. Agency may not assume any duties of Contractor.
  - 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
  - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.
  - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
  - 3. Provide incidental labor and facilities:
    - a. To provide access to Work to be tested/inspected.
    - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    - c. To facilitate tests/inspections.
    - d. To provide storage and curing of test samples.
  - 4. Provide reasonable notice to Architect and laboratory of expected time for operations requiring testing/inspection services to permit Architect and testing laboratory to schedule their activities.
  - 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect. Payment for re testing will be charged to the Contractor by deducting testing charges from the Contract Price.

#### 3.05 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections or when requested by the Architect, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, and testing, adjusting, and balancing of equipment, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

#### 3.06 DEFECT ASSESSMENT

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

- B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

### 3.07 GUARANTEE

- A. In addition to the individual guarantees and warranties provided for components of the Work, the Contractor shall provide a general warranty on the entire Work, for a period of 12 months, in the form provided within the Project Manual, warranting the quality and performance of the Work in accordance with these stipulations.

END OF SECTION

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary sanitary facilities.
- B. Temporary closures.
- C. Temporary vehicular access and parking.
- D. Project waste removal.

1.02 TEMPORARY UTILITIES

- A. Existing facilities may be used.
- B. The Owner will pay for utility charges for existing service.

1.03 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain temporary toilets. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

1.04 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Protect the vehicles of others, stored materials, site, and structures from damage.

1.05 EXTERIOR ENCLOSURES

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

1.06 INTERIOR ENCLOSURES

- A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
- B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces.

1.07 SECURITY

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

1.08 VEHICULAR ACCESS AND PARKING

- A. Coordinate access and haul routes with governing authorities and Owner.
- B. Provide and maintain access to fire hydrants, free of obstructions.
- C. Provide means of removing mud from vehicle wheels before entering streets.
- D. Designated existing on-site roads may be used for construction traffic.
- E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

#### 1.09 WASTE REMOVAL

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

#### 1.10 FIELD OFFICES

- A. Use space in the existing building for field offices.
- B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

#### 1.11 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

## SECTION 01 60 00 - PRODUCT REQUIREMENTS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. General product requirements.
- B. Prohibition of asbestos-containing materials.
- C. Re-use of existing products.
- D. Storage and protection.
- E. Product option requirements.
- F. Substitution requirements and procedures.

#### 1.02 RELATED SECTIONS

- A. Instructions to Bidders and General Conditions: Product options and substitution procedures.
- B. Section 01 62 01 - Pre-Bid Substitution Request.
- C. Section 01 62 02 - Post-Bid Substitution Request.

### PART 2 PRODUCTS

#### 2.01 EXISTING PRODUCTS

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

#### 2.02 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by the Contract Documents.
- B. Do not use products that contain 1 percent or more by weight of asbestos (asbestiform varieties of chrysotile (serpentine), crocidolite (riebeckite), amosite (cummingtonite-grunerite), anthophyllite, tremolite, or actinolite)).

#### 2.03 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only, without naming a manufacturer or brand name product: Use any product meeting those standards or description, and comply with the remaining requirements of the project.
- B. Products Specified by Naming One or More Brand Name Products: Use one of the brand name products specified, and comply with the remaining requirements of the project.
- C. Products Specified by Naming One or More Manufacturers: Use products of one of the manufacturers specified, and comply with the remaining requirements of the project.
- D. Products Specified by Naming a "Basis of Design": Use the product named as "basis of design" or obtain the approval of the Architect of specific products by other manufacturers listed in the specification, following the procedures specified for substitutions.

#### 2.04 MANUFACTURER QUALIFICATIONS AND INSTALLER QUALIFICATIONS

- A. The qualifications for manufacturers and for installers specified in the respective specification sections are requirements of the Contract.



### PART 3 EXECUTION

#### 3.01 SUBSTITUTION PROCEDURES

- A. The Architect in the Architect's sole discretion may reject or take no action on a request for substitution.
- B. The Architect may approve a request for substitution with the consent of the Owner.
- C. For time restrictions on substitution requests see the Invitation to Bidders and the General Conditions.
- D. Approval of substitutions will be made by addendum or by Contract Modification.
- E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals without separate written request complying with the requirements specified herein.
- F. Substitution Submittal Procedure:
  - 1. Submit a request for substitution for consideration. Limit each request to one proposed substitution.
  - 2. Accompany requests during the bidding period with a completed Pre-Bid Substitution Request form as specified in Section 01 62 01.
  - 3. Accompany requests after the receipt of bids with a completed Post-Bid Substitution Request form as specified in Section 01 62 02.
  - 4. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
  - 5. Accompany requests after the receipt of bids with complete documentation of cost (whether cost will increase, decrease, or remain the same) for both the specified item and the proposed item. Provide full information required for evaluation:
    - a. Quantities of materials and the cost thereof, including shipping to the site.
    - b. Manhours of labor and hourly cost including payroll taxes, insurance, and benefits for each skill or labor classification.
    - c. Quantities and costs of equipment, tools, and other material not incorporated into the work.
    - d. Overhead and profit.
    - e. Credit for deletions from Contract, similarly documented.
    - f. Justification for any change in Contract Time.
    - g. Other information requested by the Architect.
  - 6. The Architect will notify Contractor in writing of decision to accept or reject request, and when approved will incorporate the change into the Contract Documents.
- G. A request for substitution constitutes a representation that the submitter:
  - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
  - 2. Will provide the same warranty for the substitution as for the specified product.
  - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
  - 4. Waives claims for additional costs or time extension which may subsequently become apparent.

#### 3.02 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- G. Prevent contact with material that may cause corrosion, discoloration, or staining.
- H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION



SECTION 01 62 01 - PRE-BID SUBSTITUTION REQUEST

TO: LORD, AECK & SARGENT, INC.,  
1175 Peachtree Street, NE, Suite 2400, Atlanta, Georgia 30361

Substitution of the following is hereby requested in accordance with the Instructions to Bidders, the General Conditions of the contract, and Section 01 60 00.

SPECIFIED PRODUCT:

SECTION NO.:                      PAGE NO.:                      PARA. NO.:

REASON FOR REQUESTING SUBSTITUTION; CHECK ONE OR MORE:

- Contractor cannot provide the specified product, assembly, or method of construction within the Contract Time;
- The request directly relates to an "or-equal" clause or similar language in the Contract Documents;
- The request directly relates to a "product design standard" or "performance standard" clause in the Contract Documents;
- The requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations after deducting additional responsibilities Owner must assume;
- The specified product or method of construction cannot receive necessary approval by an authority having jurisdiction, and Owner can approve the requested substitution;
- Contractor cannot provide the specified product, assembly, or method of construction in a manner that is compatible with other materials and Contractor certifies that the substitution will overcome the incompatibility;
- Contractor cannot coordinate the specified product, assembly, or method of construction with other materials and Contractor certifies they can coordinate the proposed substitution; or
- The specified product, assembly, or method of construction cannot provide a warranty required by the Contract Documents and Contractor certifies that the proposed substitution provides the required warranty.
- Other (explain):

PROPOSED PRODUCT INFORMATION:

Manufacturer:

Address:

Product trade name, model number, other characteristics:

Name of fabricator or supplier:

Address:

CHECK ONE:

The proposed product complies with the contract documents in every respect except for the specified manufacturer name or brand name or model number.

The proposed product material complies with the contract documents in every respect except for deviations which are as follows:

CHECK ONE:

No changes are required in other work or products if the substitute product is approved.

Changes will be required in other work or products if the substitute product is approved, as follows:

MAINTENANCE SERVICES AND REPLACEMENT MATERIAL AVAILABILITY (IF APPLICABLE):

CONTRACTOR'S CERTIFICATION

To the Owner, to the Architect, to other bidders and sub-bidders (of any tier), and to the Contractor(s) and subcontractors and suppliers (of any tier) to whom contracts are eventually awarded in connection with the project, the undersigned warrants that the undersigned:

- has examined the bidding documents for the project,
- has investigated the proposed product and has found it to be equal or superior in all significant respects to the specified product,
- will provide the same warranty for the proposed product as for the specified product,
- will coordinate the installation and make other changes which may be required for the work to be complete in all respects, including, redesign, additional components, and additional capacity required by other work affected by the change, and
- waives all claims for additional costs and time extensions which subsequently may be come apparent and which are caused by the change.

ENCLOSURES:

Complete product data, as specified in the Contract Documents, is enclosed with this request.

Other enclosures:

THIS REQUEST IS SUBMITTED IN THE NAME OF:

Company name:

Address:

Telephone:

BY:

Authorized Signature:

Date:

Typed Name:

Title:

END OF SECTION



SECTION 01 62 02 - POST-BID SUBSTITUTION REQUEST

TO: LORD, AECK & SARGENT, INC.,  
1175 Peachtree Street, NE, Suite 2400, Atlanta, Georgia 30361

Substitution of the following is hereby requested in accordance with the Instructions to Bidders, the General Conditions of the contract, and Section 01 60 00.

SPECIFIED PRODUCT:

SECTION NO.: PAGE NO.: PARA. NO.:

REASON FOR REQUESTING SUBSTITUTION; CHECK ONE OR MORE:

- Contractor cannot provide the specified product, assembly, or method of construction within the Contract Time;
- The request directly relates to an "or-equal" clause or similar language in the Contract Documents;
- The request directly relates to a "product design standard" or "performance standard" clause in the Contract Documents;
- The requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume;
- The specified product or method of construction cannot receive necessary approval by an authority having jurisdiction, and Owner can approve the requested substitution;
- Contractor cannot provide the specified product, assembly, or method of construction in a manner that is compatible with other materials and Contractor certifies that the substitution will overcome the incompatibility;
- Contractor cannot coordinate the specified product, assembly, or method of construction with other materials and Contractor certifies they can coordinate the proposed substitution; or
- The specified product, assembly, or method of construction cannot provide a warranty required by the Contract Documents and Contractor certifies that the proposed substitution provides the required warranty.
- Other (explain):

PROPOSED PRODUCT INFORMATION:

Manufacturer:  
Address:  
Product trade name, model number, other characteristics:  
Name of fabricator or supplier:  
Address:



CHECK ONE:

- The proposed product complies with the contract documents in every respect except for the specified manufacturer name or brand name or model number.
- The proposed product material complies with the contract documents in every respect except for deviations which are as follows:

CHECK ONE:

- No changes are required in other work or products if the substitute product is approved.
- Changes will be required in other work or products, if the substitute product is approved, as follows:

MAINTENANCE SERVICES AND REPLACEMENT MATERIAL AVAILABILITY (IF APPLICABLE):

CHECK ONE:

- No change in the Contract Sum is proposed.
- Modification of the Contract Sum by adding \$ \_\_\_\_\_ is hereby requested.
- Modification of the Contract Sum by subtracting \$ \_\_\_\_\_ is hereby requested.

CHECK ONE:

- No change in the Contract Time is proposed.
- Modification of the Contract Time by adding \_\_\_\_\_ calendar days is hereby requested.
- Modification of the Contract Time by subtracting \_\_\_\_\_ calendar days is hereby requested.

CONTRACTOR'S CERTIFICATION:

- To the Owner, to the Architect, and to other contractors and their subcontractors (if any), the undersigned warrants that the undersigned:
- has examined the Contract Documents for the project,
  - has investigated the proposed product and has found it to be equal or superior in all significant respects to the specified product,
  - will provide the same warranty for the proposed product as for the specified product,
  - will coordinate the installation and make other changes which may be required for the work to be complete in all respects, including, redesign, additional components, and additional capacity required by other work affected by the change, and
  - waives all claims for additional costs and time extensions which subsequently may become apparent and which are caused by the change.
  - Will reimburse Owner for review or redesign services, when request is made after the award of contract.

ENCLOSURES:

- The following complete information is enclosed for evaluation:
1. Product data on the proposed substitution.

2. Detailed cost breakdown itemizing each of the following:
  - a. Quantities of materials and the cost thereof.
  - b. Shipping to the site.
  - c. Manhours of labor and hourly cost including payroll taxes, insurance, and benefits for each skill or labor classification.
  - d. Quantities and costs of equipment, tools, and other material not incorporated into the work.
  - e. Overhead and profit.
  - f. Credit for deletions from Contract, similarly documented.
3. Justification for any change in Contract Time.
4. Other information requested by the Architect.

Other enclosures:

THIS REQUEST IS SUBMITTED IN THE NAME OF:

Company name:

Address:

Telephone:

BY:

Authorized Signature:

Date:

Typed Name:

Title:

END OF SECTION



## SECTION 01 70 00 - EXECUTION REQUIREMENTS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Cleaning and protection.
- F. Starting of systems and equipment.
- G. Demonstration and instruction of Owner personnel.

#### 1.02 PROJECT CONDITIONS

- A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- B. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere.
- C. Rodent and Pest Control: Provide methods, means, and facilities to prevent rodents and pests and insects from accessing or invading premises.
- D. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

#### 1.03 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.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

### PART 2 PRODUCTS - NOT USED

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

### 3.02 PREPARATION

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

### 3.03 PREINSTALLATION MEETINGS

- A. Notify Architect sufficiently in advance of meeting date to allow for coordination with Architect's schedule.
- B. Prepare agenda and preside at meeting:
  - 1. Review conditions of examination, preparation and installation procedures.
  - 2. Review coordination with related work.
- C. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

### 3.04 GENERAL INSTALLATION REQUIREMENTS

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

### 3.05 ALTERATIONS

- A. Drawings showing existing construction and utilities are not record documents or precise surveys of actual conditions.
  - 1. Verify that construction and utility arrangements are as shown.
  - 2. Report discrepancies to Architect before disturbing existing installation.
  - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Separate areas in which alterations are being conducted from other areas that are still occupied; provide, erect, and maintain temporary dustproof partitions of construction.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
  - 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
  - 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- D. Remove existing work as indicated and as required to accomplish new work.
  - 1. Remove items indicated on drawings.

2. Relocate items indicated on drawings.
  3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
  4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
  2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
  3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
    - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
    - b. Provide temporary connections as required to maintain existing systems in service.
  4. Verify that abandoned services serve only abandoned facilities.
  5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- F. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
  2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
  3. Repair adjacent construction and finishes damaged during removal work.
  4. Patch as specified for patching new work.
- G. Adapt existing work to fit new work.
- H. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
- I. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
- J. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
- K. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
  2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
  3. Patch as specified for patching new work.
- L. Clean existing systems and equipment.
- M. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- N. Do not begin new construction in alterations areas before demolition is complete.

### 3.06 CUTTING AND PATCHING

- A. Execute cutting and patching including excavation and fill to complete the work, to uncover work in order to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit products together to integrate with other work.
- B. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- C. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- D. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- E. Restore work with new products in accordance with requirements of Contract Documents.
- F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.
- H. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
- I. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.
- J. Patch or replace surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. Repair substrate prior to patching finish. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

### 3.07 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

### 3.08 PROTECTION OF INSTALLED WORK

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

### 3.09 STARTING SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.

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

### 3.10 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate to Owner's personnel the start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at equipment location.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season near the onset of the other season.
- C. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.
- D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

### 3.11 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

### 3.12 FINAL CLEANING

- A. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
- B. Use cleaning materials that are nonhazardous.
- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces, dust and mop hard flooring.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean permanent washable filters and replace disposable filters of operating equipment.
- F. Clean debris from roofs, gutters, downspouts, and drainage systems.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

END OF SECTION





## SECTION 02 41 19 – SELECTIVE DEMOLITION

### PART 1 GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Demolition and removal of selected portions of building or structure excluding removal of hazardous materials and toxic substances.
  - 2. Demolition of selected built site elements.
  - 3. Abandonment and removal of existing utilities and utility structures are specified in other.

#### 1.02 RELATED REQUIREMENTS

- A. Section 01 7200 -Unanticipated Archaeological Discoveries Plan
- B. Section 31 2200 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations.
- C. Section 31 2300 – Excavating, Backfilling and Compacting for Utilities: Fill material for filling holes, pits, and excavations generated as a result of removal operations.
- D. Section 31 2513 - Temporary Silt Fence

#### 1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Schedule: Indicating proposed sequence of operations for selective demolition work to Owner's Representative and CMAR's Representative for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control protection.
  - 1. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of CMAR's on-site operations.
- C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
  - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
  - 2. Identify demolition firm and submit qualifications.
  - 3. Include a summary of safety procedures.
- D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

#### 1.04 JOB CONDITIONS

- A. Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished.
  - 1. Conditions existing at time of inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within structure may occur by Owner's removal and salvage operations prior to start of selective demolition work.
- B. Traffic: Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
  - 1. Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- C. Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.

1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.
  2. Maintain fire protection services during selective demolition operations.
- D. Environmental Controls: Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.
1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
- E. Occupancy: Owner may occupy portions of the building during selective building demolition. Conduct demolition work in manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities that will affect Owner's normal operations.
- F. Demolition and Removal: Items to be removed but of salvageable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed.
1. Storage or sale of removed items on site will not be permitted.
- G. Protections: Provide temporary barricades and other forms of protection to protect personnel and general public from injury due to demolition work.
1. Provide protective measures as required to provide free and safe passage of demolition personnel to unoccupied portions of building.
  2. Erect temporary covered passageways if required for safety of building occupants or by authorities having jurisdiction.
  3. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities.
  4. Protect existing site improvements scheduled to remain during demolition operations. Repair damage to original condition as required.
  5. Protect existing walks to remain using suitable coverings when necessary.
  6. Protect all site improvements to remain upon completion of project.
  7. Protect all shrubs and trees to remain upon completion of project.
- H. Damages: Promptly repair damages caused to adjacent facilities by demolition work.
- I. Flame Cutting: Do not use cutting torches for removal until work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations. Maintain portable fire suppression devices during flame-cutting operations as required by OSHA, CMAR and/or Fire Marshall.

## PART 2 PRODUCTS –NOT USED

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. General: Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished.
1. Cease operations and notify CMAR's Representative immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.
  2. Locate, identify, stub off, and disconnect utility services that are not indicated to remain.

- A. Provide bypass connections as necessary to maintain continuity of service to occupied areas of building. Provide minimum of 72 hours advance notice to Owner if shutdown of service is necessary during changeover.

### 3.02 DEMOLITION

- A. General: Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.
  - 1. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.
  - 2. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.
  - 3. All piping, conduit, etc. to be demolished is to be removed to source and not abandoned in place. Demolition shall extend beyond the limits of construction to the source or closest active portion of the system.
  - 4. Completely demolish and remove foundation walls below existing ground surface. Demolish and remove below-grade wood or metal construction. Break up below-grade concrete slabs.
    - A. For demolition of the Niggli Theatre portion of Stillwell Sciences Building, foundations shall be removed to create a clean break from the remainder of Stillwell Sciences Building. Repair and replace damaged waterproofing at foundations to remain. Repair and replace sub-surface drainage system to tie in to the future drainage for STEM Building.
  - 5. Completely fill below-grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, stones over 6 inches in diameter, roots, or other organic matter. Compaction must meet geotechnical requirements as specified elsewhere.
  - 6. If objects of suspected archeological significance are encountered during demolition or any other activity during construction, follow Section 01 7200 -Unanticipated Archaeological Discoveries Plan.

### 3.03 SALVAGED MATERIALS

- A. Salvaged Items: Where indicated on Drawings as "Salvage/Deliver to Owner," carefully remove indicated items, clean, store, and turn over to Owner and obtain receipt.
  - 1. Historic artifacts, including cornerstones and their contents, commemorative plaques and tablets, antiques, and other articles of historic significance, remain property of Owner. Notify Owner's Representative if such items are encountered and obtain acceptance regarding method of removal and salvage for Owner.

### 3.04 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove from building site debris, rubbish, and other materials resulting from demolition operations. Debris must be removed daily. Transport and legally dispose off site. The Contractor is responsible for dump fees. Do not use the CMAR's dumpsters.
  - 1. See Supplementary Conditions for action required by the Contractor if hazardous materials are encountered during demolition operations.
  - 2. Burning of removed materials is not permitted on project site.

### 3.05 CLEANUP AND REPAIR

- A. General: Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean.
  - 1. At all areas of demolition work where noted, completely demolish foundation walls below existing ground surface.
  - 2. Remove concrete slabs on grade within site boundaries.
  - 3. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 2300.
  - 4. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

### 3.06 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain required permits. CMAR to provide an ASBESTOS PERMIT APPLICATION AND NOTIFICATION FOR DEMOLITION/RENOVATION (FORM DHHS 3768) application for an asbestos removal permit (10A NCAC 41C .0600) and as a National Emission Standard for Hazardous Air Pollutants (NESHAP) notification of demolition and/or renovation in the state of North Carolina. Forms and more information can be found at: <http://epi.publichealth.nc.gov/asbestos/demolition.html>
  - 2. Provide, erect, and maintain temporary barriers and security devices.
  - 3. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
  - 4. Do not close or obstruct roadways or sidewalks without permit.
- B. Do not begin removal until receipt of notification to proceed from CMAR.
- C. Protect existing structures and other elements that are not to be removed.
  - 1. Provide bracing and shoring.
  - 2. Prevent movement or settlement of adjacent structures.
  - 3. Stop work immediately if adjacent structures appear to be in danger.
- D. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- E. If hazardous materials are discovered during removal operations, stop work and notify CMAR and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
- F. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

### 3.07 EXISTING UTILITIES

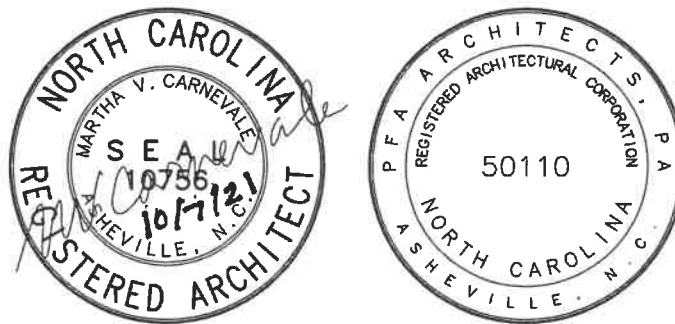
- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

- E. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- F. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.08 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION



SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete formwork.
- B. Floors and slabs on grade.
- C. Concrete reinforcement.
- D. Joint devices associated with concrete work.
- E. Concrete curing.

1.02 REFERENCE STANDARDS

- A. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
- C. ACI 301 - Specifications for Structural Concrete; 2016.
- D. ACI 302.1R - Guide to Concrete Floor and Slab Construction; 2015.
- E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- F. ACI 308R - Guide to External Curing of Concrete; 2016.
- G. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).
- H. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2018.
- I. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2018a.
- J. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.
- K. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2018.
- L. ASTM C150/C150M - Standard Specification for Portland Cement; 2019a.
- M. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2016.
- N. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.
- O. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair; 2013.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- C. Mix Design: Submit proposed concrete mix design.
  - 1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
  - 2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.
- D. Test Reports: Submit report for each test or series of tests specified.

#### 1.04 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.

### PART 2 PRODUCTS

#### 2.01 FORMWORK

- A. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
  - 1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
  - 2. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

#### 2.02 REINFORCEMENT MATERIALS

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
  - 1. Type: Deformed billet-steel bars.
  - 2. Finish: Unfinished, unless otherwise indicated.
- B. Steel Welded Wire Reinforcement (WWR): Galvanized, plain type, ASTM A1064/A1064M.
  - 1. WWR Style: 4 x 8-W6 x W10.
- C. Reinforcement Accessories:
  - 1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
  - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

#### 2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
- B. Fine and Coarse Aggregates: ASTM C33/C33M.
- C. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

#### 2.04 BONDING AND JOINTING PRODUCTS

- A. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

#### 2.05 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Normal Weight Concrete:
  - 1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3,000 pounds per square inch.
  - 2. Water-Cement Ratio: Maximum 40 percent by weight.
  - 3. Total Air Content: 4 percent, determined in accordance with ASTM C173/C173M.
  - 4. Maximum Slump: 3 inches.
  - 5. Maximum Aggregate Size: 1/2 inch.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

#### 3.02 PREPARATION

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
- B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.



- C. Prepare existing concrete surfaces to be repaired according to ICRI 310.2R.
- D. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

### 3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
- B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

### 3.04 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Ensure reinforcement and embedded parts will not be disturbed during concrete placement.
- D. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
- E. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

### 3.05 SLAB JOINTING

- A. Locate joints as indicated on drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

### 3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. Maximum Variation of Surface Flatness:
  - 1. Exposed Concrete Floors: 1/4 inch in 10 feet.
  - 2. Under Seamless Resilient Flooring: 1/4 inch in 10 feet.
  - 3. Under Carpeting: 1/4 inch in 10 feet.
- B. Correct the slab surface if tolerances are less than specified.
- C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

### 3.07 CONCRETE FINISHING

- A. Repair surface defects, including tie holes, immediately after removing formwork.
- B. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
  - 1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.
  - 2. Decorative Exposed Surfaces: Trowel as described in ACI 302.1R; take measures necessary to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, surfaces to receive liquid hardeners, surfaces to receive dry-shake hardeners, surfaces to be polished, and all other exposed slab surfaces.

### 3.08 CURING AND PROTECTION

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Surfaces Not in Contact with Forms:
  - 1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by saturated burlap.
    - a. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.
  - 2. Final Curing: Begin after initial curing but before surface is dry.
    - a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.

### 3.09 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.

### 3.10 DEFECTIVE CONCRETE

END OF SECTION

## SECTION 03 39 00 - CONCRETE CURING AND SEALING

### PART 1 GENERAL

#### 1.01 SUMMARY

- A. Curing of cast-in-place concrete.

#### 1.02 REFERENCES

- A. ACI 308R - Guide to External Curing of Concrete; 2016.
- B. AASHTO M 182 -- Standard Specification for Burlap Cloth Made from Jute or Kenaf; American Association of State Highway and Transportation Officials; 2005.

#### 1.03 SUBMITTALS

- A. Product Data:
  - 1. For material pre-approved by Kattera: Product data is on file in the Kattera Arena and Apollo databases. No additional submittal of product data is required.
  - 2. For material not previously approved and documented by Kattera: Submit product data demonstrating compliance with the requirements of the Contract Documents.

### PART 2 PRODUCTS

#### 2.01 SUBSTITUTIONS

- A. Refer to Section 01 60 00 - Product Requirements.

#### 2.02 CURING COMPOUNDS

- A. General: Where compounds are proposed for use on surfaces to which finishes, coatings, or coverings subsequently will be applied, compound shall possess demonstrated compatibility with finish, coating, or covering, and use shall be subject to approval of the Architect.
- B. Disappating Liquid Membrane-Forming Curing Compounds: Comply with ASTM C 309, Type 1-D, with fugitive dye.
- C. Curing/Sealing/Hardening Compound:
  - 1. The Ashford Formula; Curecrete Chemical Company.
  - 2. Chemisil; ChemMasters.
  - 3. Industraseal; US Mix Co.
- D. Moisture-retaining coverings for curing
  - 1. Burlap: AASHTO M 182, Class 2 jute or kenaf cloth.

### PART 3 EXECUTION

#### 3.01 CONCRETE CURING AND PROTECTION

- A. General:
  - 1. Begin curing procedures immediately following the commencement of the finishing operation.
  - 2. Prevent premature drying of freshly placed concrete, and protect from excessively cold or hot temperatures until concrete has cured.
  - 3. Provide curing of concrete per ACI 308R, by one of the methods listed and as appropriate to service conditions and type of applied finish in each case.
- B. Curing Period:
  - 1. Not less than 7 days for standard cements and mixes.
  - 2. Not less than 4 days for high early strength concrete using Type III cement.
- C. Formed Surfaces: Cure formed concrete surfaces by moist curing with forms in place for full curing period or until forms are removed.
  - 1. Keep wet wooden or metal forms exposed to heat of the sun.

2. If forms are removed prior to completion of curing process, continue curing by one of the applicable methods specified.
- D. Water Curing of Surfaces Not in Contact with Forms:
1. Start initial curing as soon as free water has disappeared, but before surface is dry.
  2. Keep continuously moist during the curing period by uninterrupted use of any of the following:
    - a. Water ponding.
    - b. Water-saturated sand.
    - c. Water-fog spray.
    - d. Saturated burlap: Provide 4 inch minimum overlap at joints.
  3. Continue final curing to end of curing period.
  4. Avoid rapid drying at end of curing period.
- E. Curing Compounds for Surfaces Not in Contact with Forms:
1. Curing compound: Apply at rate stated by manufacturer to conform with moisture-retention requirements specified, using second, immediate application at right angles to first, if necessary, and reapply if damaged by rain.
  2. Curing and hardening compound: Apply one or more applications as recommended by manufacturer to achieve maximum hardness and at rate stated by manufacturer to conform with moisture-retention requirements specified.
  3. Use curing compounds only in locations permitted or required. Do not apply to surfaces to receive other finishes, coatings, or coverings.
- F. Do not use curing or hardening compounds in areas to be covered with bonded materials. Use only wet curing of such surfaces unless compounds are removed by brush-off blast cleaning of concrete. (Acid etching is not acceptable as a means of removal.) Bonded materials include:
1. Epoxy or urethane paint, resinous flooring, or similar special coating.
- G. Use either wet curing or a disappating curing compound approved by the material manufacturer for surfaces to receive the following materials:
1. Carpet and resilient flooring (tile or roll goods).
- H. During and following curing period, protect concrete from temperature changes of adjacent air in excess of 5 degrees F per hour and 50 degrees F per 24 hours. Progressively adjust protective measures to provide uniform temperature changes over entire concrete surface.
- I. Sealed Finish:
1. Apply Curing/Sealing/Hardening compound in accordance with manufacturer's instructions as a curing compound to fresh concrete. Near final completion, power buff to a satin sheen.
  2. Apply sealer to exposed slabs in rooms indicated in the Finish Schedule.

END OF SECTION

SECTION 04 01 20 - MASONRY CLEANING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cleaning New Masonry.

1.02 CLEANING STANDARD REQUIRED:

- A. General:
  - 1. Clean masonry to remove mortar scum and mortar droppings.
  - 2. Degree of cleanliness in the Work shall match that achieved in the approved mock-ups.

1.03 SUBMITTALS

- A. Product Data:
  - 1. Submit for each cleaning agent (detergent, chemical, etc.).
  - 2. Submit MSDS for each cleaning agent.
  - 3. Submit manufacturer's detailed application instructions for proprietary cleaners.
- B. Submit masonry unit manufacturer's recommendations for cleaning agents.
- C. Submit a description of proposed protection of surrounding materials on building and Project site, and control of runoff during operations. Describe in detail the materials, methods, and equipment to be used.
- D. If materials and methods other than those indicated are proposed for cleaning work, provide a written description, including evidence of successful use on other comparable projects, and a testing program to demonstrate their effectiveness for this Project.

1.04 DEFINITIONS

- A. All pressures measured at discharge end.
- B. Garden Spray: Spray of hand-pump-up garden-type ("Hudson") sprayer with nozzle adjusted to a cone-shape. Powered garden-type sprayers providing equivalent spray are also acceptable. Stainless steel or plastic parts required (galvanized not acceptable).
- C. Very-Low Pressure Spray: 30 psi (nominal) through a 3/4-inch diameter hose fitted with a nozzle producing a conical spray of approximately 60 degrees applied at a distance not closer than 4 feet from the surface. Provide pressure/volume/cut-off valve at discharge end.
- D. Low-Pressure Spray: 100 to 200 psi; 4 to 6 gpm.
- E. Medium-Pressure Spray: 200 to 600 psi; 4 to 6 gpm.
- F. High-Pressure Spray: 600 to 1200 psi; 4 to 6 gpm.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver other materials to Project site in manufacturer's original and unopened containers, labeled with type and name of product and manufacturer.
- B. Comply with manufacturer's written instructions for minimum and maximum temperature requirements for storage.

1.06 PROJECT CONDITIONS

- A. Clean surfaces only when air temperature is 40 degrees F and above and will remain so for at least 7 days after completion of cleaning.

1.07 SEQUENCING AND SCHEDULING - NEW MASONRY

- A. Clean masonry in a timely manner and within the time limitations recommended by the mortar manufacturer and liquid cleaner manufacturer - generally within 7 to 21 days after brick masonry is installed and within 14 to 28 days after stone masonry is installed, depending on temperature and mortar strength.
- B. Perform masonry cleaning and restoration work in the following sequence:

1. Install temporary materials where required to prevent entry of water or chemicals into interior of masonry work, windows, doors, louvers, and other openings.
2. Protect from damage windows, doors, louvers, and other openings as well as other non-masonry surfaces that are not to be cleaned. Provide temporary masking of such surfaces where cleaners might damage such surfaces.
3. Clean masonry surfaces.

## PART 2 PRODUCTS

### 2.01 SUBSTITUTIONS

- A. Refer to Section 01 60 00 - Product Requirements.

### 2.02 MATERIALS

- A. Water: clean, potable water.
- B. Warm water for mixing cleaning solutions.
- C. pH paper with 3 colors to identify numeric pH level.

### 2.03 MIXES

- A. Liquid Cleaners for New Masonry:
  1. Basis of Design: VanaTol; Prosoco, Inc.
- B. Other Manufacturers provided they meet the performance standards of the basis of design.
  1. Fabrikem New Masonry Cleaner Type L; Fabrikem.
  2. 202V Vana-Stop; Diedrich Technologies, Inc.

### 2.04 TEMPORARY COVERS

- A. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, and polished masonry surfaces from the damaging effects of acidic and alkaline masonry cleaners.
- B. Polyethylene Sheet.
- C. Adhesive Tape: Non-staining, leaving building surface residue-free after tape is removed.

## PART 3 EXECUTION

### 3.01 PROTECTION

- A. The Building: Where cleaners and rinses have not been demonstrated to be non-deleterious to non-masonry portions of the building, provide temporary masking of non-masonry surfaces.
- B. Control of Runoff:
  1. Do not allow cleaners and rinses to collect, pond, or form soft muddy conditions at the base of the building that do not dissipate within 24 hours.
- C. Protection of Vegetation: A portion of the existing plant life is indicated elsewhere in the Contract Documents to be removed. Do not allow cleaners and rinses to contact vegetation to remain.
- D. If inadvertent spills of cleaner contact vegetation or other building elements, rinse immediately with potable water until free of cleaner.
- E. Do not apply sprays during windy conditions sufficient to carry overspray into contact with other surfaces, vegetation, or people.

### 3.02 CLEANING, GENERAL

- A. Identify "panels" of the building to be cleaned sequentially.
- B. Proceed within each panel from the base of the building to the top, unless otherwise approved.
- C. Prewetting:

1. As cleaning proceeds upward, maintain lower portions and immediately adjacent portions continuously wet and streak-free and soil-free.
  2. Extend the wetted area horizontally beyond the immediate area to be cleaned.
  3. Wet the area beneath the area to be cleaned, from grade level up to the area to be cleaned.
  4. Maintain these adjacent areas wet with water until rinsing is complete to avoid streaking and deposition of cleaners and residues onto adjacent surfaces.
- D. Thoroughly remove cleaners by rinsing with potable water. A final rinse shall be performed from the top of the building down to the base of the building.
- E. Clean building surfaces in a uniform manner. Include flat surfaces, cornices, moldings, ornament, recesses, tops and undersides, etc., to produce a uniformly clean result.
- F. Do not apply different cleaners on a given area unless the cleaner used previously has been thoroughly washed away.
- G. Adjustments to meet Project Conditions:
1. Repeat cleaning procedures or adjust dwell times or adjust the amount or type of scrubbing effort or adjust concentration of cleaners (or a combination of the preceding), depending upon the amount and type of soil or stain present on the various parts of the building, and so as to achieve a uniformly clean result and without change in Contract Time or Price.
  2. Obtain the Architect's approval of such adjustments.
  3. Do not exceed concentrations or dwell times or repeat procedures beyond the limits specified or approved by the Architect.

### 3.03 SPRAYS

- A. Do not use power-assisted spray without the written authorization of the Architect.
- B. Provide very low pressure spray, taking water from hose bibbs to portions of the building required to be cleaned.
- C. If the Architect determines that unassisted pressure at hose-end from the building water supply does not provide adequate pressure or volume, provide power-assisted spray adjusted to simulate very-low pressure spray without change in Contract Time or Price. Obtain the written authorization from the Architect.
- D. If the Contractor so requests and the Architect determines that due to remote location or configuration or other Project factors, it is impracticable to use hoses to rinse selected portions, provide power-assisted spray adjusted to simulate very-low pressure spray without change in Contract Time or Price. Obtain the written authorization from the Architect.

### 3.04 APPLICATION OF LIQUID CLEANERS

- A. Remove as much plant growth as possible using a knife blade and stiff bristle brush. Dry-brush the surface before wetting to remove bulk growth.
1. Pre-wet the area to be cleaned (and the adjacent areas) with a water spray.
    - a. Extend the wetted area horizontally beyond the immediate area to be cleaned.
    - b. Wet the area beneath the area to be cleaned, from grade level up to the area to be cleaned.
    - c. Maintain these adjacent areas wet with water until rinsing is complete to avoid streaking and deposition of cleaners and residues onto adjacent surfaces.
  2. Apply the solution to the affected area using either a garden spray or medium-stiff natural bristle brush. Use large, flat brushes for flat areas; use small brushes to access recesses, reveals, and detail of ornament.
    - a. Scrub with a natural or artificial bristle brush and allow to dwell as necessary depending on degree of soiling and application temperatures.
    - b. Dwell times are estimated to be 20 to 30 minutes between 40 and 70 degrees F, and 10 to 15 minutes at 70 degrees F and above, but may range up to an hour or longer

- depending upon degree of soiling, scrubbing effort, and other factors. Consult manufacturer for required dwell time for the product being used.
- c. Do not allow cleaners to dry out. Reapply cleaner or mist with water to keep the surface saturated, and scrub periodically until the growth, stain, or soil is removed.
3. After-Wash, where indicated by manufacturer's instructions:
    - a. Thoroughly rinse cleaner from surface with low-pressure spray water.
    - b. Immediately apply after-wash to surface and allow to dwell for 3 to 5 minutes.
  4. Thoroughly rinse the surface with low-pressure spray water.
    - a. Test liquid rinse run-off drops with pH paper to ensure that cleaning solutions have been effectively removed. Continue rinsing until pH is neutral. (pH testing of liquid detergent is not required or effective.)
    - b. Allow to dry.
    - c. Test as often as necessary to ensure reliable, repeatable results and when otherwise requested by the Architect.
  5. Use prepared solutions within 24 hours.

END OF SECTION



SECTION 04 20 00 - UNIT MASONRY

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
  - 1. Concrete Block.
  - 2. Clay or Shale Facing Brick.
  - 3. Mortar and Grout.
  - 4. Reinforcement and Anchorage.
  - 5. Accessories.
- B. Products Installed but not Furnished Under this Section, Including, but not Limited to:
  - 1. Items specified elsewhere and which are built into masonry.
  - 2. Lintels.
  - 3. Frames for openings.
  - 4. Anchors for built-in items.
  - 5. Inserts and connectors.
  - 6. Utility items.
- C. Products Furnished but not Installed Under this Section, Including, but not Limited to:
  - 1. Insulation retainer clips.

1.02 REFERENCES

- A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.
- B. ASTM A580/A580M - Standard Specification for Stainless Steel Wire; 2018.
- C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2018.
- D. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2016.
- E. ASTM C1019 - Standard Test Method for Sampling and Testing Grout for Masonry; 2019.
- F. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2018a.
- G. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2015a.
- H. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.
- I. ASTM C150/C150M - Standard Specification for Portland Cement; 2019a.
- J. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.
- K. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2019.
- L. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019.
- M. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2018.
- N. ASTM C476 - Standard Specification for Grout for Masonry; 2019.
- O. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2017.
- P. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2016a.
- Q. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.
- R. "Standard Practice for Bracing Masonry Walls Under Construction", Council for Masonry Bracing.

### 1.03 DEFINITIONS

- A. As listed in TMS 402/602.
- B. "To match existing building": No visible difference when viewed by the Architect as specified under "Appearance of Completed Masonry" at the end of this Section. The Architect's approval of initial product submittals, sample panels, etc., is preliminary only. Final approval shall be on the basis on in-place mock-ups and permanent work.

### 1.04 SUBMITTALS

- A. Product Data:
  - 1. Masonry units.
  - 2. Cementitious materials.
  - 3. Reinforcing steel.
  - 4. Joint reinforcement.
  - 5. Anchors.
  - 6. Accessories.
- B. Other Product Data - Test Reports:
  - 1. Masonry units: Net area compressive strength.
    - a. Where less than 50,000 sf of masonry is required, submit test results of net area compressive strength of units based on standard plant runs.
    - b. Where 50,000 sf or more of masonry is required, submit test results of net area compressive strength of units based on actual lots produced for the project, and tested at least once per 50,000 sf.
  - 2. Sand: Sieve analysis and aggregate void ratio. Perform test not more than 60 days before date of submittal.
  - 3. Mortar:
    - a. Mix design: Proportions of each material by volume.
  - 4. Grout Mix Design:
    - a. Proportions of each material.
    - b. Compressive strength test results.
- C. Shop Drawings:
  - 1. Sizes, locations, and fabrication dimensions of reinforcing steel.
  - 2. Design data for engineered veneer anchors:
  - 3. For veneer anchors used in cavities larger than 4.5 inches, submit design data prepared by the veneer anchor manufacturer demonstrating that anchors comply with the requirements of the Building Code / TMS 402/602; design data shall bear the seal of a professional engineer licensed to practice in the State in which the Project is located.
- D. Office Samples:
  - 1. Mortar: 2-inch samples.
  - 2. Masonry units demonstrating full range of color and texture.
- E. Proposed hot and cold weather procedures.

### 1.05 BRICK AND MORTAR SAMPLE PANELS

- A. Where new work is specified to match existing:
  - 1. Prepare 3 large and 3 small sample panels demonstrating a range of proposed mortar color and masonry units.
  - 2. Construct panels on site in a location designated by the Architect.
  - 3. Panel Size:
    - a. Fixed: 4 feet high by 4 feet wide.
    - b. Portable: 5 courses high by 2 feet wide with strapping for handling.
  - 4. The appearance of mortar, joint work, and masonry units in the sample panels shall match the appearance of the existing when evaluated by the Architect in accordance with "Appearance of Completed Work" at the end of this Section.

- B. If a sample panel is not approved, make appropriate adjustments and construct additional panels.

#### 1.06 PRE-INSTALLATION MEETING

- A. Convene one week before starting work of this section.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Do not allow materials to become damaged or contaminated by other materials.
- B. Provide on-site storage of masonry units required for not less than 4 weeks production.
1. Store units raised above ground on pallets or similar flooring to prevent moisture pick-up.
  2. Store units under cover to prevent moisture pick-up from rain or snow.
  3. Do not tarp or wrap units so as to trap moisture or to permit condensation to form.
  4. Allow air to circulate freely around units.
  5. Use only masonry units that have been stored thus for not less than 3 weeks.
- C. Sand:
1. Maintain sand at a constant moisture content.
  2. Cover pile when not in use.
  3. Arrange pile for free drainage.
  4. Do not use the bottom portion of the pile (wet or in contact with earth) in mortar.
  5. At Contractor's option use bagged, kiln-dried sand.
- D. Cement and Lime:
1. Store materials raised above ground on pallets or similar flooring to prevent moisture pick-up.
  2. Store materials under cover to prevent moisture pick-up from rain or snow.
  3. Do not tarp or wrap materials so as to trap moisture or to permit condensation to form.
  4. Allow air to circulate freely around units.
  5. Do not use bags that have been broken or exposed to moisture.

#### 1.08 PROJECT SITE CONDITIONS

- A. Cold Weather Requirements. When either the ambient air temperature or the temperature of masonry units is below 40°F:
1. Submit proposed procedures to the Architect.
  2. Materials:
    - a. Ensure that temperature of masonry units is greater than 20°F when laid in the masonry.
    - b. Remove visible ice from masonry units before laying in the masonry.
    - c. Heat mortar sand or mixing water to produce mortar temperatures between 40°F and 120°F at the time of mixing. Maintain mortar above freezing until used in masonry.
  3. Protection when laying masonry:
    - a. Use heat sources when ambient temperature is between 20°F and 25°F on both sides of the masonry under construction.
    - b. Provide wind breaks when wind velocity is in excess of 15 mph.
    - c. When ambient temperature is below 20°F, provide temporary enclosure for the masonry under construction and provide temporary heat to maintain temperature above 32°F within the enclosure.
  4. Protection after laying masonry:
    - a. When mean daily temperature (average of high and low) is between 32°F and 40°F, protect completed masonry from rain or snow by covering with a weather-resistant membrane for 24 hours after construction.
    - b. When mean daily temperature (average of high and low) is between 25°F and 32°F, completely cover completed masonry with a weather-resistant membrane for 24 hours after construction.
    - c. When mean daily temperature (average of high and low) is between 20°F and 25°F, completely cover completed masonry with insulating blankets for 24 hours after construction.

- d. When mean daily temperature (average of high and low) is below 20°F, maintain the temperature of masonry above 32°F for 24 hours after construction by providing temporary enclosure with temporary heat, by providing electric heating blankets or infrared heat lamps, or by other approved methods.
- B. Hot weather construction.
1. Submit proposed procedures to the Architect.
  2. Preparation. The following requirements shall be met prior to conducting masonry work.
    - a. Temperature. When the ambient temperature exceeds 100°F (38°C), or exceeds 90°F (32°C) with a wind velocity greater than 8 mph (13 km/h):
      - 1) Necessary conditions and equipment shall be provided to produce mortar having a temperature below 120°F (49°C).
      - 2) Sand piles shall be maintained in a damp, loose condition.
    - b. Special conditions. When the ambient temperature exceeds 115°F (46°C), or 105°F (40°C) with a wind velocity greater than 8 mph (13 km/h), observe the above requirements and in addition, provide shade so that direct sunlight does not fall on materials and mixing equipment.
  3. Construction. The following requirements shall be met while masonry work is in progress.
    - a. Temperature. When the ambient temperature exceeds 100°F (38°C), or exceeds 90°F (32°C) with a wind velocity greater than 8 mph (13 km/h):
      - 1) The temperature of mortar and grout shall be maintained below 120°F (49°C).
      - 2) Mixers, mortar transport containers and mortar boards shall be flushed with cool water before they come into contact with mortar ingredients or mortar.
      - 3) Mortar consistency shall be maintained by retempering with cool water. Do not retemper colored mortar to the degree that variations in color are apparent in the completed masonry.
      - 4) Mortar shall be used within 2 hours of initial mixing.
    - b. Special conditions. When the ambient temperature exceeds 115°F (46°C), or exceeds 105°F (40°C) with a wind velocity greater than 8 mph (13 km/h), observe the above requirements and in addition cool mixing water used for mortar and grout. The use of ice shall be permitted in the mixing water prior to use. Ice shall not be permitted in the mixing water when added to the other mortar or grout materials.
  4. Protection. When the mean daily temperature exceeds 100°F (38°C), or exceeds 90°F (32°C) with a wind velocity greater than 8 mph (13 km/h), newly constructed masonry shall be fog sprayed until damp at least three times a day until the masonry is three days old.

## PART 2 PRODUCTS

### 2.01 SUBSTITUTIONS

- A. Refer to Section 01 60 00 - Product Requirements.

### 2.02 CONCRETE MASONRY UNITS

- A. Load Bearing Units: ASTM C90.
  1. Average net area compressive strength of units, ASTM C140/C140M: At least 2,150 psi.
  2. Hollow block.
- B. Provide specially shaped units where required by project conditions, including but not limited to:
  1. Corner block: Square.
  2. At control joints: Sash block.
  3. Lintels.
  4. Bond beams.
- C. Nominal Face Size: 8 by 16 inches, unless otherwise indicated on the drawings.
  1. Nominal Thickness: As indicated on the drawings.

### 2.03 CLAY OR SHALE MASONRY UNITS

- A. Face Brick: ASTM C216.

1. Average net area compressive strength of units, ASTM C67: At least 4,150 psi.
  2. Grade SW.
  3. Color and texture: Match existing brick.
- B. Nominal Size: 4 by 8 by 2-2/3 inches.
- C. Provide specially extruded or molded units where specially shaped units are required by project conditions.
1. Special shapes sawn from standard units will be permitted where the sawn face is not exposed to view or to weather.

#### 2.04 MORTAR MATERIALS

- A. Deliver cementitious materials to the job site in bags containing factory proportioned quantities of cement and lime in each bag according to the approved design mix, unless an alternate method of batching is approved by the Architect. Manufacturer's label on each bag shall clearly indicate compliance with this specification. Labels bearing the words "masonry cement" shall in addition bear the words "Portland-lime" or other clear indication of compliance with this specification.
- B. Portland Cement: ASTM C150/C150M, Type I.
1. For exposed masonry provide white cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
- C. Masonry Cement and Mortar Cement are not acceptable.
- D. Hydrated Lime: ASTM C207, Type S.
- E. Mortar Aggregate: ASTM C144.
- F. Grout Aggregate: ASTM C404.
- G. Pigments for Colored Mortar: Iron or chromium oxides with demonstrated stability and colorfastness and complying with ASTM C979/C979M.
1. Provide color matching the existing mortar color after existing mortar has been cleaned.
- H. Water: Clean and potable.

#### 2.05 REINFORCING AND ANCHORS

- A. Reinforcing Steel:
1. ASTM A615/A615M, Grade 60, deformed, plain finish.
- B. The manufacturers specified herein have standard or made-to-order veneer anchors of sufficient strength to meet the Project requirements. Provide anchor thickness/gage as necessary to meet the required loads but in no case less than that specified below. For veneer anchors used in cavities larger than 4.5 inches, make arrangements with the veneer anchor manufacturer to provide anchors of the type specified and of the necessary thickness and strength to comply with the requirements of the Building Code / TMS 402/602, and submit design data bearing the seal of a professional engineer licensed to practice in the State in which the Project is located.
- C. For the materials below, provide products of one of the following:
1. Blok-Lok.
  2. Heckmann.
  3. H & B.
- D. For the joint reinforcing and anchoring products below, provide the following material:
1. Exterior walls (all wythes):
    - a. Stainless steel ASTM A580/A580M, Type 304.
- E. Bar Positioners:
1. Blok-Lok.
  2. Heckmann 376, 377, 378.
  3. H & B #RB, #RB-Twin.
- F. Joint Reinforcement: ASTM A951/A951M.

1. Side wire size: W1.7 (No. 9).
2. Cross wire size: W1.7 (No.9).
3. Configurations:
  - a. CMU backup for clay or shale brick veneer:
    - 1) Ladder type, 1 side rod per face shell; between 5/8 inch and 1 inch mortar coverage at each face.
    - 2) Adjustable veneer anchors, wire size W2.8 embedded into veneer at least 1-1/2 inches and extending not closer than 5/8 inch from the exposed face.
    - 3) Blok-Lok Blok-Lok "Adjustable Econo-Cavity Lok II BL42" with "Wedge-Lok" insulation retainers.
    - 4) H & B "Lox-All Ladder Type #270".

G. Masonry Veneer Anchors:

1. Sized for embedment into veneer at least 1-1/2 inches and extending not closer than 5/8 inch from the exposed face.
2. Clearance between tie and base parts: Not more than 1/16 inch.
3. Over CMU back-up: Joint reinforcement with adjustable ties (specified above).
4. Over existing CMU or cast-in-place concrete:
  - a. Blok-Lok BL-5407.
  - b. Heckmann #213 plus #282.
  - c. H & B HB-213.
5. Over CMU or cast-in-place concrete where necessary to comply with spacing requirements:
  - a. Blok-Lok BL-5407.
  - b. Heckmann #213 plus #282.
  - c. H & B HB-213.
6. Fasteners for anchors over masonry and cast-in-place concrete: Brass or Type 304 stainless steel expansion bolts provided by anchor manufacturer.

H. Insulation retainer clips:

1. Owens Corning Thermafiber RainBarrier Clip.
2. Blok-Lok Wedge-Lok.
3. Heckmann.
4. H & B #HB200 Washer.

2.06 FLASHINGS

- A. Receivers and Counterflashing: Specified in Section 07 62 00.
- B. Flashing Materials: Self-adhesive sheet membrane, as specified in Section 07 65 00.

2.07 ACCESSORIES

- A. Control Joint Filler: Rubber shear key, width 1" nominal less than wythe.
  1. Blok-Lok.
  2. Heckman #352.
  3. H & B #RS.
- B. Expansion Joint Filler: Soft, closed cell neoprene rubber. Thickness 3/8 inch vertical joints, 1/4 inch horizontal joints. Depth equal to wythe less 3/8 inch.
  1. Blok-Lok.
  2. Heckmann.
  3. H & B #NS Closed-Cell Neoprene Sponge.
- C. Weeps and Vents: UV resistant polypropylene.
  1. Blok-Lok.
  2. Heckmann #85 Cell Vent.
  3. H & B #QV Quadro-Vent.
- D. Confinement Mesh: Inert, non-corrosive mesh to confine grout while maintaining bond with mortar.

1. Blok-Lok.
2. Heckmann #267.
3. H & B #MGS-Mortar/Grout Screen.

#### 2.08 MIXING

- A. Mortar for Clay or Shale Unit Masonry: ASTM C270, proportion specification; Type N.
- B. Mortar for Concrete Unit Masonry: ASTM C270, proportion specification; Type N unless otherwise indicated on the structural drawings.
- C. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio or that permitted by TMS 402/602.
- D. Mixing Setting Mortar:
  1. Use a paddle type mechanical batch mixer.
  2. Use a positive means of measuring volumes of ingredients. Each batch shall contain a known volume of each ingredient. Measuring by shovels is not acceptable.
  3. Mix batches using whole sacks of cementitious materials unless another method of equivalent accuracy is approved by the Architect.
  4. Do not mix partial batches. Discard unused mix.
  5. Use mortar as soon as possible.
  6. Mortar that loses water by evaporation shall be retempered by the addition of water to restore its original consistency, providing the mortar has not begun to set.
  7. Do not re-temper colored mortar to the degree that variations in color are apparent in the completed masonry.
  8. Discard mortar that has begun to set.
  9. Discard mortar that has not been used after 2-1/2 hours after original mixing.
- E. Mixing order when lime and cement are bagged together (confirm with manufacturer and notify Architect if manufacturer's instructions differ):
  1. Water: 75% of total.
  2. Sand: Half.
  3. Lime and cement: All.
  4. Sand: The remainder.
  5. Water: To a workable consistency.
  6. Mix: Not less than 3-1/2 nor more than 5 minutes after the introduction of cementitious material.
- F. Mixing order when lime and cement are bagged in two separate bags:
  1. Water: 75% of total.
  2. Sand: Half.
  3. Lime: All.
  4. Mix: 2 minutes.
  5. Portland Cement: All.
  6. Sand: The remainder.
  7. Water: To a workable consistency.
  8. Mix: 5 full minutes.
- G. Grout: ASTM C476.
  1. Compressive strength, ASTM C1019: As indicated on the structural drawings, or if not indicated, provide grout complying with the proportions of Table 1, ASTM C476.
  2. Slump, ASTM C143/C143M: 8 to 11 inches.
  3. Fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
- H. Mixing Grout: Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.

## 2.09 FABRICATION OF REINFORCING STEEL

- A. Shop-fabricate reinforcing steel in compliance with TMS 402/602.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verification of Conditions:
  - 1. Verify that reinforcing dowels are properly positioned.
  - 2. Verify that items to be built-in such as pipes, conduit, boxes, and other items are properly positioned and do not interfere with masonry or reinforcing.
  - 3. Verify that non-masonry structural elements such as foundations for masonry, columns, beams, floor slab edges are properly positioned and do not interfere with masonry or required cavity.
  - 4. Verify that field measurements of project conditions allow for proper coursing both vertically and horizontally, unless otherwise required by the contract documents. Notify the Architect of non-coursing conditions.
- B. Ensure that as-built field tolerances of other trades will permit the proper construction of masonry.
- C. Bearing and Cavity Width:
  - 1. Do not allow cavity widths to exceed 4-1/2 inches (from outside face of stud or masonry back-up to inside face of veneer). Do not allow clear air space behind veneer to be less than 1-1/2 inches.
  - 2. Do not allow clay or shale brick to bear on less than 2/3 of their actual width.
  - 3. Do not allow hollow CMU to bear on less than their full width
- D. Ensure that materials to be covered by masonry (such as steel studs, sheathing, insulation, membrane flashings, dampproofing, etc.) are complete and have been inspected and approved before covering with masonry.
- E. As masonry construction progresses and before covering flashings with masonry, verify that flashings are properly located, sealed watertight, and constructed so as to direct water to the outside.
- F. Where conditions are not compliant, notify the Architect before beginning masonry construction.
- G. Provide corrected conditions before beginning masonry construction.

### 3.02 PREPARATION

- A. Temporarily brace masonry until permanent bracing is provided.
- B. Brace masonry in accordance with "Standard Practice for Bracing Masonry Walls Under Construction," Council for Masonry Bracing.
- C. Clean reinforcing steel when required by TMS 402/602.

### 3.03 PLACING UNITS

- A. Solid units:
  - 1. Ensure bed and head joints are full of mortar without voids.
  - 2. Bevel bed joints with an appropriate quantity of mortar to fully fill the bed joint without overfilling, and without forcing excess mortar into the cavity or onto the face of units.
  - 3. Do not furrow bed joints.
  - 4. Place mortar on the head of the unit prior to placing, and shove into place.
  - 5. Do not slush head joints.
- B. Hollow Units:
  - 1. Construct with fully mortared face shells.
  - 2. Construct fully mortared web joints:
    - a. At the first course of bearing.
    - b. All courses of columns, piers, and pilasters.



c. Perimeter of grouted construction.

- C. Ensure that units are in final position and adjusted to line, level, and plane before 60 seconds have expired since mortar contact with unit. Do not disturb units after this time. If further adjustment is required, remove unit and mortar and install fresh unit and mortar. Removed units may be reused if cleaned promptly and allowed to dry 24 hours before reuse.
- D. Strike-off extruded mortar from the face and rear of the unit using a lifting and cutting motion of the trowel. Avoid dropping mortar in the cavity. Do not smear of mortar on the face of units.

3.04 COURSING AND JOINTING

- A. Place units in running bond, unless otherwise indicated.
- B. Do not tooth masonry. Rack masonry 1 unit per course where masonry is not laid continuously.
- C. Joint thickness: 3/8 inch. Construct joints of uniform thickness.
  - 1. Exception: Bed joint at foundations: Not less than 1/4 nor more than 3/4 inch.
  - 2. Exception: Where stretching or compressing joints is necessary to accommodate dimensional tolerances or other conditions, consult with the Architect to determine acceptable tolerances.
- D. Expansion Joints in Clay or Shale Masonry:
  - 1. Ensure that expansion joints are free of mortar and other obstructions.
  - 2. Place compressible expansion joint filler at proper depth to receive joint sealant.
- E. Control Joints in Concrete Masonry:
  - 1. Construct control joints using sash block and control joint filler topped with joint sealant specified in Division 7.
- F. Joint Shape:
  - 1. Concave, unless otherwise indicated.
- G. Openings: Construct masonry openings for windows, doors, and penetrations to allow for proper sealant joint width between masonry and other material.
  - 1. Joint width adjacent to openings: 3/8 inch unless otherwise indicated on the drawings.
- H. Where walls and partitions abut columns or other construction:
  - I. Where differing exterior masonry materials meet (brick, CMU, cast stone, precast concrete, cast-in-place concrete, etc.), rake back mortar to receive joint sealant specified in Division 7.

3.05 VENEER

- A. Install back-up wythe, dampproofing, control joint sealant, and sealant joints between back-up and abutting construction. Obtain the Architect's approval before covering with veneer or other materials.
- B. Before constructing veneer, verify that spacing of veneer anchors in back-up is as specified.
- C. Where built-in items such as pipes, conduit, boxes, and other items occur, ensure that such items do not interfere with proper cavity drainage. If such occur, consult with the Architect and provide custom flashing or other measures as approved.

3.06 CLEANOUTS AND WEEPS

- A. Clay or Shale Masonry: Provide cleanouts at each flashing elevation, spaced 24 inches on center. Clean out accumulated mortar droppings from the cavity before mortar hardens throughout each work day and at the end of each work day. Achieve a mortar-free cavity.
- B. Obtain the Architect's approval before permanently closing cleanouts.
- C. Install weep devices at 24 inches on center.
- D. Ensure that plastic weep device is seated on flashing - not held above flashing by mortar.
- E. Three courses below flashings, install vent devices at 24 inches on center, offset 12 inches horizontally from weeps above.

### 3.07 REINFORCING STEEL

- A. Secure reinforcing steel against displacement prior to grouting.
- B. Locate vertical bar positioners at the following locations:
  - 1. At the top of the first course.
  - 2. One course below the top of wall or partition.
  - 3. Not more than 4 feet vertically between positioners.
- C. Provide at least 1/4 inch fine grout cover or 1/2 inch coarse grout cover between steel and adjacent masonry unit or formed surface.
- D. Placement tolerance: As specified in TMS 402/602.
- E. Do not bend reinforcing on site or after placement without the Architect's approval.

### 3.08 GROUTING

- A. Construct cleanouts in accordance with TMS 402/602.
- B. Ensure that inside face of cells or cavities aligned, and unobstructed by interior offsets of more than 1/2 inch.
- C. Confine grout within intended spaces.
- D. Place grout in accordance with TMS 402/602.

### 3.09 HORIZONTAL JOINT REINFORCEMENT IN CMU

- A. Reinforce all CMU walls and partitions.
- B. Lay joint reinforcement directly on masonry units and cover with mortar. Provide mortar cover specified in Part 2.
- C. Lap joint reinforcement at least 6 inches.
- D. At corners and intersecting walls, install joint reinforcement with prefabricated corners and tees.
- E. Vertical Spacing:
  - 1. 16 inches on center, unless otherwise indicated.
  - 2. Prefabricated units at corners and intersecting walls, 8 inches on center. Extend legs at least 30 inches in each direction.
  - 3. First 2 courses above and below openings. Extend at least 16 inches beyond each side of opening.
  - 4. First 2 courses below the tops of walls.
  - 5. Parapets: 8 inches on center.
- F. Do not continue horizontal joint reinforcement through control joints.

### 3.10 ANCHORING CMU TO STRUCTURAL FRAME

- A. Anchor CMU to structure as indicated on structural drawings.

### 3.11 VENEER ANCHORS

- A. Space anchors as follows:
  - 1. Not more than 2.67 sf of wall area per anchor.
  - 2. Not more than 18 inches vertically.
  - 3. Not more than 32 inches horizontally.
  - 4. Openings larger than 16 inches in either direction: Install additional anchors within 12 inches of opening, spaced at not more than 36 inches on center.
  - 5. Locate the first row of anchors not more than 16 inches above bearing elevation.
  - 6. Locate the last row of anchors not more than 8 inches below the top of masonry panel (top of parapet, top of wall, underside of structure, below shelf angle, etc.).
  - 7. Where veneer corners are not masonry bonded (an expansion joint occurs at the corner), locate the first column of anchors within 12 inches of outside face of masonry in both directions.
  - 8. Where veneer corners are masonry bonded (no expansion joint at the corner), locate the first column of anchors within 16 inches of the outside face of masonry in both directions.

- B. Install adjustable anchors to allow for expansion of clay or shale masonry and contraction of back-up.

### 3.12 MASONRY FLASHING

- A. Specified in Division 7.

### 3.13 OTHER MATERIALS

- A. Build-in items specified elsewhere including, but not limited to:
  1. Lintels.
  2. Door frames. Fill hollow metal frames with grout.
  3. Window frames.
  4. Frames for openings.
  5. Anchors for built-in items.
  6. Inserts and connectors.
  7. Utility items.
- B. Simultaneously construct chases and contiguous walls or partitions.
- C. Do not embed wood (whether or not preservative treated) or other organic materials.
- D. Do not embed aluminum that has not been coated with an approved anti-corrosion coating.

### 3.14 TOLERANCES

- A. Conform to both code and visual tolerances.
- B. Code Tolerances: As specified in TMS 402/602.
- C. Appearance of Completed Work: Variations in dimension, joint thickness, plumb, plane, line, alignment, offset, location in plan or elevation, etc., that are visible to the Architect under the criteria below shall be considered defective and shall, if ordered by the Architect, be corrected even though such conditions may fall within the tolerances specified in TMS 402/602.
  1. The Architect will view the completed masonry to approve or reject the color consistency of the mortar, cleanliness of the masonry, and other aesthetic aspects of the work.
  2. If the Contractor so requests, an initial determination will be made at not earlier than 2 weeks of age.
  3. The Architect is the sole judge of aesthetic effect.
  4. Initial approval will be given as a part of periodic site visits.
  5. Final approval will be given only after scaffolding is removed and not earlier than 4 weeks after masonry has been laid.
  6. Criteria for acceptance: Masonry shall be free of objectionable variations in color of the mortar, cleanliness of the new masonry, or other defective aesthetic effects. Lippage, or cocked or tilted masonry units are not acceptable.
  7. Conditions for approval of completed appearance: Work will be viewed under normal daylight from a distance of 20 feet (or more at the Architect's discretion), except in those areas where work occurs adjacent to entrances and walking surfaces, which will be viewed at close hand.
  8. Variations from Code tolerances and defects that affect serviceability are not limited by viewing distance.

### 3.15 IN PROGRESS CLEANING

- A. Arrange means, methods, and techniques of construction masonry and the work of other trades to avoid and prevent the soiling or staining of in-progress and completed masonry.
- B. On-site Storage:
  1. Protect masonry units from soil and mud.
  2. Store units on pallets or equivalent to raise units above ground or place on well drained hard pavement. Do not place units directly on the ground.
  3. Cover units with tarps to keep out precipitation. Ventilate tarps at the base to allow air circulation and to avoid condensation.
- C. Protection:

1. Protect the base of masonry after the first course is laid. Use sand, straw, sawdust, plastic sheeting, etc., to prevent stains from mud and soil. Ensure proper drainage at base of wall to avoid retaining water and muddy conditions.
  2. Cover the top of masonry with waterproof coverings at the end of each work day. Covers shall drape vertically at least 6 inches down inside and outside face of masonry. Secure covers against blowing wind.
  3. Set scaffold far enough from the wall to allow mortar droppings to fall to the ground without staining completed masonry. At the end of each work day remove or tilt up scaffold board nearest the wall to dump mortar droppings and to prevent rainfall from splattering mortar from the board to newly constructed masonry.
- D. Laying Masonry:
1. After spreading bed joint mortar and before placing brick, cut mortar from the wall face with the edge of a trowel to prevent mortar running down the wall.
  2. After units are laid, cut off excess mortar, capturing it with the trowel so as not to allow excess to drop down the face of the wall.
- E. After Completion:
1. Do not allow other trades to stain or soil completed masonry. Provide protection to avoid staining or soiling.
  2. Keep mud protection at the base of masonry until permanent landscaping is completed and viable, effective groundcover is well established.
- F. Tooling:
1. Tool joints when they are thumbprint hard.
  2. Tool joints at about the same "age" from lift to lift of masonry, from section to section of masonry, from day to day, and from crew to crew.
  3. Tool joints with a consistent technique.
  4. Then cut off mortar tailings with a trowel and, using a medium soft hair bricklayer's brush, brush mortar burrs and dust from the face of units.
  5. At the start of work each morning, remove any remaining excess mortar from the face of units with a wire brush.
- G. Non-Compliance with any of the above provisions is defective workmanship and grounds for rejection.

### 3.16 FINAL CLEANING

- A. Specified in Section 04 01 20.

END OF SECTION

SECTION 06 41 00 - ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wood Veneer Cabinets.
- B. Cabinet Hardware.
- C. Factory Finishing.

1.02 REFERENCES

- A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.
- B. ANSI A208.1 - American National Standard for Particleboard; 2016.
- C. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2016.
- D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).
- E. BHMA A156.9 - American National Standard for Cabinet Hardware; 2015.
- F. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2016.
- G. NHLA G-101 - Rules for the Measurement & Inspection of Hardwood & Cypress; 2015.

1.03 SUBMITTALS

- A. Product Data.
- B. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.
- C. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.

1.04 QUALITY ASSURANCE

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

1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Protect units from moisture damage.

1.06 PROJECT CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

- A. Refer to Section 01 60 00 - Product Requirements.

2.02 CABINET CONSTRUCTION

- A. Perform cabinet construction in accordance with AWI/AWMAC/WI (AWS) Section 400 as follows:
  - 1. Wood Veneer Cabinets: Premium quality.

2.03 WOOD MATERIALS

- A. Hardwood Lumber: NHLA G-101; Graded in accordance with AWI/AWMAC/WI (AWS), average moisture content of 5-10 percent; species as follows:
  - 1. Exposed Surfaces: Natural Maple.
  - 2. Semi-Exposed Surfaces: White (sap) Maple.

## 2.04 PANEL MATERIALS

- A. Formaldehyde:
  - 1. Panel materials shall comply with California Green Building Materials Table 5.504.4.5 requirements for formaldehyde emission limits measured in accordance with California Air Resources Board, Air Toxics Control Measure for Composite Wood when tested in accordance with ASTM E1333.
    - a. Hardwood plywood - veneer core or composite core: 0.05 ppm.
    - b. Particleboard: 0.09 ppm.
    - c. Medium density fiberboard (MDF): 0.11 ppm.
    - d. Thin medium density fiberboard - not exceeding 1/16 inch or 8 mm: 0.13 ppm.
  - 2. Panel products shall either be labeled and invoiced as meeting the Composite Wood Products regulation (CCR Title 17 Section 93120 et seq) or shall be accompanied by a chain of custody certification or shall be labeled and comply with PS-1 or PS-2 or Australian AS/NZS 2260 or European 636 3S.
- B. Hardwood Faced Plywood: HPVA HP-1; graded in accordance with AWI/AWMAC/WI (AWS); type of glue recommended for specific application; thickness as required.
  - 1. Face Veneer; provide one of the following:
    - a. Exposed Surfaces: HPVA HP-1 Grade A, Maple, plain sliced, random-matched.
    - b. Semi-Exposed Surfaces: HPVA HP-1 Grade A, Maple, plain sliced, random-matched.
  - 2. Core; provide one of the following:
    - a. Particleboard.
    - b. Medium Density Fiberboard.
- C. Particleboard: ANSI A208.1; medium density industrial type, composed of wood chips bonded with interior grade adhesive under heat and pressure; sanded faces; thickness as required; use for components indicated on drawings.
- D. Medium Density Fiberboard (MDF): ANSI A208.2; composed of wood fibers pressure bonded with moisture resistant adhesive to suit application; sanded faces; thickness as required.
- E. Hardboard: ANSI A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth two sides (S2S). Use for drawer bottoms, dust panels, and other components indicated on drawings.
- F. Hardwood Edgebanding: For exposed portions of cabinetry, use solid hardwood edgebanding matching species, color, grain, and grade of veneer faces for exposed portions of cabinetry.

## 2.05 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Fasteners: Size and type to suit application.
- C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel, or chrome-plated finish in exposed locations.
- D. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

## 2.06 HARDWARE

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards and coordinated shelf rests, satin chrome finish, for nominal 1 inch spacing adjustments.
- C. Drawer and Door Pulls: "U" shaped wire pull, stainless steel with satin finish, 4 inch centers.
- D. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with satin finish.
- E. Catches: Magnetic.

F. Drawer Slides:

1. Manufacturers:
  - a. Basis of Design: Accuride International, Inc.
  - b. Hafele America Co.
  - c. Knappe & Vogt Manufacturing Company.
2. Light/Medium Duty Drawer Slides For Drawers 24 inches Wide or Less: Accuride 7434 with overtravel.
  - a. Overtravel: 1 inch.
  - b. Type: All ball bearing, full extension, rail-mounted, hold-in detent, smooth progressive movement.
  - c. Capacity: 100 pounds per pair for 18-inch slide length.
  - d. Finish: Clear zinc.

G. Hinges: 5 knuckle type; stainless or chromium plated steel with satin polished finish.

2.07 FABRICATION - CABINETS

- A. Cabinet Style: Flush overlay.
- B. Cabinet Doors and Drawer Fronts: Flush style.
- C. Drawer Construction Technique: Dovetail joints.
- D. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- E. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- F. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- G. Wood Veneer Panel Product: Comply with requirements of quality standard for specified Grade and as follows:
  1. Provide center matched panels at each elevation.
  2. Carry figure of cabinet fronts to toe kicks.

2.08 FACTORY FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.
- C. Finish work in accordance with AWI/AWMAC/WI (AWS) Section 5, System 5 Conversion Varnish, Transparent.
- D. Seal internal surfaces of cabinets with one coat of specified finish. Brush apply only.
- E. Apply finishes in the factory.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION - CABINETS

- A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- B. Use concealed joint fasteners to align and secure adjoining cabinet units.
- C. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- D. Secure cabinets to floor using appropriate angles and anchorages.

- E. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION



## SECTION 06 83 16 - FIBERGLASS REINFORCED PANELING

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Fiberglass reinforced plastic panels.
- B. Trim.

#### 1.02 REFERENCE STANDARDS

- A. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2017.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2019b.

#### 1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

#### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Fiberglass Reinforced Plastic Panels:
  - 1. Crane Composites, Inc; Glasbord: [www.cranecomposites.com](http://www.cranecomposites.com).
  - 2. Marlite, Inc; Standard FRP: [www.marlite.com](http://www.marlite.com).
  - 3. Nudo Products, Inc; Fiberlite FRP: [www.nudo.com](http://www.nudo.com).

#### 2.02 PANEL SYSTEMS

- A. Wall Panels:
  - 1. Panel Size: 4 by 8 feet.
  - 2. Panel Thickness: 0.10 inch.
  - 3. Surface Design: Smooth.
  - 4. Color: White.
  - 5. Attachment Method: Adhesive only, sealant joints, no trim.

#### 2.03 MATERIALS

- A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
  - 1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
- B. Trim: Vinyl; color coordinating with panel.
- C. Adhesive: Type recommended by panel manufacturer.
- D. Sealant: Type recommended by panel manufacturer; white.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate conditions are ready to receive the work of this section.

### 3.02 INSTALLATION - WALLS

- A. Install panels in accordance with manufacturer's instructions.
- B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.
- C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.
- D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
- E. Install panels with manufacturer's recommended gap for panel field and corner joints.
- F. Place trim on panel before fastening edges, as required.
- G. Fill channels in trim with sealant before attaching to panel.
- H. Install trim with adhesive and screws or nails, as required.
- I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
- J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

## SECTION 07 21 00 - BOARD AND BATT INSULATION

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Extruded Polystyrene Board Insulation on:
  - 1. Masonry cavity wall or veneer construction.
- B. Polyisocyanurate Board Insulation:
  - 1. Exterior walls, beneath cladding.

#### 1.02 REFERENCES

- A. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2019.
- B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2019.
- C. ASTM D1621 - Standard Test Method for Compressive Properties Of Rigid Cellular Plastics; 2016.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2019b.
- E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- F. ICC (IBC)-2015 - International Building Code; 2015.
- G. ICC (IBC)-2018 - International Building Code; 2018.
- H. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2019.

#### 1.03 SUBMITTALS

- A. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- B. Shop Drawings:
  - 1. Illustrate fastener spacing and pattern for securing rigid insulation materials. Coordinate and show fasteners for other materials that penetrate insulation, such as cladding anchors.

#### 1.04 ENVIRONMENTAL REQUIREMENTS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

### PART 2 PRODUCTS

#### 2.01 SUBSTITUTIONS

- A. Refer to Section 01 60 00 - Product Requirements.

#### 2.02 FOAM PLASTIC BOARD INSULATION MATERIALS

- A. Extruded Polystyrene Board Insulation: ASTM C578; Extruded polystyrene board with natural extruded skin surfaces; with the following characteristics:
  - 1. Board Thickness: As indicated on the drawings.
  - 2. Board Edges: Square.
  - 3. Surface Burning Characteristics of the insulation and facings tested separately: Flame spread / smoke developed index not greater than 25/450; ASTM E84.
  - 4. In masonry cavities: Compressive strength at least 15 psi.
  - 5. Adhesive: Type recommended by insulation manufacturer for application.
- B. Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C1289.
  - 1. General:

- a. Board Thickness: As indicated on the drawings.
  - b. Surface Burning Characteristics of the insulation and facings tested separately:  
Flame spread / smoke developed index not greater than 25/450; ASTM E84.
  - c. Labeling: Packaging, containers, and insulation shall be labeled as required by ICC (IBC)-2015 / ICC (IBC)-2018 2603.2.
    - 1) Each piece of insulation shall be labeled as required by ICC (IBC)-2015 / ICC (IBC)-2018 2603.5.6.
  - d. Exterior Wall Assemblies: Approved for use by ICC Evaluation Service for Type I, II, III and IV Construction and assemblies of the type employed on this project.
2. Board for use in or on Exterior Walls:
- a. Tested and meeting the acceptance criteria per ICC (IBC)-2015 / ICC (IBC)-2018 2603.5, including NFPA 285, for Type I-IV Construction.
  - b. Tested per NFPA 285 for the claddings of the types and configurations used on this project.
    - 1) And compliant with the limitations enumerated in the respective ICC-ESR or Engineering Report.
3. Foil Faced Board:
- a. Foil facers; product with perm rating of less than 0.1 perm ASTM E96/E96M.
  - b. Compressive Strength, ASTM D1621: Not less than 25 psi.
  - c. Acceptable Product:
    - 1) Atlas Roofing Corporation EnergyShield Pro.
    - 2) Atlas Roofing Corporation EnergyShield Pro2.
    - 3) DuPont de Nemours, Inc. Thermax (ci) Exterior Insulation.
    - 4) DuPont de Nemours, Inc. Thermax Xarmor (ci) Exterior Insulation.
    - 5) DuPont de Nemours, Inc. Thermax Heavy Duty.
    - 6) DuPont de Nemours, Inc. Thermax White Finish.
    - 7) R Max TSX-8500.
4. Insulation Joint Tape for Exterior Walls: Provide insulation manufacturer's recommended board joint tape for sealing joints, seams and cladding anchor penetrations through the insulation layer. HDPE facer with butyl rubber adhesive; 20 mil nominal thickness.
- a. 4-inch-width for insulation board joints.
  - b. For framing faces up to 2 inches wide, use 4-inch-wide tape. For framing faces up to 4 inches wide, use 6-inch-wide tape. For other project conditions, use 9 or 12-inch-wide material as necessary.
  - c. Acceptable Products:
    - 1) DuPont Weathermate Straight Flashing; high-density polyethylene (HDPE) film facer with butyl rubber adhesive.
    - 2) DuPont Flashing Tape; polypropylene-butyl laminate, 20 mils thick.
    - 3) Typar Butyl Flashing, 20 mils thick.
5. Sheathing Tape for Exterior Walls: High-strength, permanent acrylic adhesive, sheathing tape.
- a. Acceptable Products:
    - 1) DuPont Weathermate Construction Tape.
    - 2) DuPont Tyvek Contractor Tape.
    - 3) Typar Construction Tape.
6. Insulation Fasteners: Provide insulated sheathing manufacturer's recommended organic-polymer or other corrosion-protective coated steel screw fasteners for anchoring sheathing to wood studs, metal studs, or masonry and cementitious substrates as applicable. Provide plastic insulation retainer head 1-3/4 to 2 inch diameter. Fastener length and size based on wall sheathing thickness.
- a. Acceptable Manufacturers:
    - 1) Wind-lock Corporation; [www.wind-lock.com](http://www.wind-lock.com).
    - 2) Rodenhouse; [www.rodenhouse-inc.com](http://www.rodenhouse-inc.com).

7. Edge Closure: Cold-formed metal channel; unequal leg 2" x insulation thickness x 1-1/2" and other configurations as required by Project conditions; Type 304 stainless steel; 0.0375 inch thick.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation .
- B. Verify substrate surfaces are flat, free of honeycomb, fins, or irregularities.

#### 3.02 POLYISOCYANURATE BOARD INSTALLATION ON OUTSIDE FACE OF EXTERIOR WALLS

- A. Provide edge closure channels at:
  1. Doors, windows, and other openings through insulation.
  2. Where insulation starts and stops (tops, bottoms, and sides of insulation abutting dissimilar materials or terminating the insulation).
  3. At inside and outside corners.
- B. Install insulation in accordance with manufacturer's recommendations.
  1. Space fasteners at not more than 12 inches o.c. at panel perimeter and 16 inches o.c. in panel field. Locate perimeter fasteners 3/8 inch from panel edge. Perimeter fasteners can also be located on the centerline of abutting board joints due to the 1.75" diameter of the washer; a maximum of two boards may be bridged per fastener.
  2. Abut panels tightly together and around openings and penetrations.
  3. Install sheathing panels horizontally. Use maximum lengths to minimize number of joints.
  4. Drive fasteners to bear tight and flush with surface of insulation. Do not countersink.
- C. Joint Tape:
  1. Apply butyl joint tape to insulation joints with firm hand pressure, free of wrinkles and fishmouths.
  2. Apply butyl tape to seal face of insulation with face of edge closure members and cladding framing.
  3. For framing faces up to 2 inches wide, use 4-inch-wide tape. For framing faces up to 4 inches wide, use 6-inch-wide tape.
  4. Press entire surface area of tape firmly against substrate using 6 inch steel hand roller (4 or 6 inch for 4 inch tape) on flat surfaces, or by burnishing with blunt tool such as back of a utility knife on small areas and corners. Continue operation until entire sheet is well bonded to substrate.
  5. Where horizontal tape occurs, place an additional layer of sheathing tape on the top horizontal edge of the butyl joint tape; position sheathing tape 2/3's of width on the upper insulation face and 1/3's width on the butyl tape face. Place sheathing tape without wrinkles or fishmouths. Press with a roller as described above.
  6. At intersections of vertical and horizontal tape, ensure that tape is weather-lapped to shed water.

#### 3.03 POLYSTYRENE BOARD INSTALLATION AT MASONRY CAVITY OR VENEERED WALLS

- A. Apply adhesive to back of boards:
  1. Apply a continuous bead 1 to 2 inches from the top and sides of each board plus a segmented bead (1" gaps at 2 feet o.c., nominal) along the bottom of each board.
- B. Install boards to fit snugly between wall ties.
  1. Place membrane surface against adhesive.
- C. Install boards horizontally on walls.
  1. Install in running bond pattern.
  2. Butt edges and ends tightly to adjacent boards and to protrusions.
- D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

- E. Secure insulation boards to the back-up with masonry veneer anchors and insulation retainer clips specified in Division 4.

#### 3.04 MISCELLANEOUS VOIDS

- A. Fill cracks and crevices with insulation. Seal against the passage of air, moisture, dust, and noise.

#### 3.05 PROTECTION OF FINISHED WORK

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 25 30 - WEATHER-RESISTANT BARRIER (ADHESIVE SHEET)

PART 1 GENERAL

1.01 SECTION INCLUDES:

- A. Self-adhesive wall membrane.

1.02 SYSTEM DESCRIPTION

- A. Install sheet materials to form a secondary weather barrier to direct water penetrating the exterior skin down and out to the exterior.
- B. Extend sheet materials across joints and seams in similar and dissimilar substrates and around doors, windows, and other openings to form a continuous barrier against intrusion of water and air.

1.03 SUBMITTALS

- A. Product Data:
  - 1. For approval: Written technical product information for each type of product to demonstrate products comply with contract documents. Provide all products of this section from one manufacturer.
  - 2. For information (Project record): Manufacturer's detailed installation instructions. No provision of such instructions shall be deemed to delete any requirement of the Contract Documents without the approval of the Architect issued as a Contract Modification.
- B. Reports: Submit reports signed by Contractor, installer, and membrane manufacturer's representative of:
  - 1. Preapplication review.
  - 2. Preconstruction inspection.
  - 3. In-progress inspections.
  - 4. Completion inspections.
- C. Warranty.

1.04 QUALITY ASSURANCE

- A. Preapplication Review: Schedule a meeting before start of installation with installer and waterproofing manufacturer's representative to review procedures for substrate preparation and waterproofing application.
  - 1. Review contract document requirements, manufacturer's product data, and application instructions.
  - 2. Manufacturer's representative shall instruct first-time installers in proper installation procedures, and shall be available throughout project for trouble shooting upon request.
- B. Install sheet materials in mock-ups specified elsewhere.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original unopened containers.
- B. Store containers in a dry location at temperatures under 100°F. Do not double-stack pallets.
- C. During cold weather installation (under 60°F), store sheet in heated enclosure (70°F to 90°F) 12 hours prior to installation; Remove only such material as is needed for immediate use.
- D. Do not install material when substrate temperature is under 40°F unless special procedures recommended by the manufacturer are followed and successful adhesion is obtained and mock-ups are approved by the Architect.
- E. Do not expose to sunlight for more than 30 days, either when in storage or after installation, before covering with subsequent construction.

1.06 SEQUENCING

- A. Backing Strip: Ensure that backing strip is installed before installing gypsum sheathing.

## 1.07 WARRANTY

- A. Provide Special Project Warranty specified in Section 01 78 10.

## PART 2 PRODUCTS

### 2.01 SUBSTITUTIONS

- A. Refer to Section 01 60 00 - Product Requirements.

### 2.02 MANUFACTURERS

- A. Provide products of one of the following:
  1. W. R. Grace & Co.
  2. W. R. Meadows Inc.
  3. Henry.
  4. Tremco.

### 2.03 MATERIALS

- A. Self-Adhesive Wall Membrane:
  1. Composite material: Rubberized asphalt bonded to high density polyethylene film; 40 mils total thickness.
  2. Release sheet to protect adhesive layer.
  3. Product:
    - a. W. R. Grace & Co.; Perm-A-Barrier Wall Membrane.
    - b. W. R. Meadows Inc.; Air Shield Air Barrier and Flashing Membrane.
    - c. Henry: Blueskin SA.
    - d. Tremco: ExoAir 110.
- B. Termination Mastic:
  1. Trowel or caulking grade rubberized asphalt-based mastic.
  2. Products:
    - a. W. R. Grace & Co.; Bituthene Mastic.
    - b. W. R. Meadows Inc.; Seal Tight Pointing Mastic.
    - c. Henry: Air-Bloc 06 Trowel Grade.
    - d. Tremco: Dymonic FC.
- C. Sealant: Specified in Section 07 90 00.
- D. Solvent Base Primer:
  1. Rubber-based, solvent dispersed liquid for substrate preparation.
  2. Products:
    - a. W. R. Grace & Co.; B2 Low VOC Content Primer.
    - b. W. R. Meadows Inc.; Mel Prime Solvent Based Primer.
    - c. Henry: Blueskin LVC Adhesive.
    - d. Tremco: ExoAir 10 Primer.
- E. Metal Edge:
  1. Stainless steel, Type 304, 0.018" thick, with 2B finish.
  2. Size to project beyond face of construction 1/2" (drip edge on a 45 degree angle) and to extend not less than 4 inches nominal across masonry wythe.
  3. Provide 3/8" hem on outside edge.
- F. Carrier Sheet: Provide where self-adhesive sheet spans the cavity or other gap in construction.
  1. Same material as metal edge.
- G. Termination Bar: Extruded aluminum or formed stainless steel, pre-punched with slotted holes at 8 inch o.c. for fasteners.
  1. Fasteners for bar on stud back-up: For steel studs #12 screws with Type 304 stainless steel head and shaft, carbon steel tip; for wood studs Type 304 stainless steel nails or screws.



2. Fasteners for bar on concrete or masonry back-up: Stainless steel drive pins with lead expansion shields.
3. Backing Strip for stud and sheathing substrates: Galvanized steel sheet metal, 4 inches wide.

### PART 3 - EXECUTION

#### 3.01 BACKING STRIP

- A. When cold formed metal framing installation is complete and before installing gypsum sheathing, install backing strip to face of studs in a continuous fashion, directly behind the location where termination bars will be installed.

#### 3.02 EXAMINATION AND PREPARATION

- A. Review installed substrate surfaces for compliance with preparation requirements. Document necessary actions for correcting unacceptable surface conditions.
- B. Verify that surfaces are smooth, sound, clean, and dry, and that components which will penetrate self-adhesive sheet are complete and rigidly installed.
- C. Temperature: Install primer and sheet when temperature of substrate is 40°F or above.
- D. Do not install sheet until substrate condition is acceptable to the Contractor, installer, and sheet manufacturer's representative.
- E. Concrete Substrates:
  1. Verify that form release agents or curing compounds used on surfaces are compatible with sheet products.
  2. Where incompatible products have been used, remove in accordance with sheet manufacturer's instructions.
  3. Remove dust and chalk from substrates by dry brushing or pressure washing. Allow surface to dry thoroughly.
  4. Remove and repair honeycomb, aggregate pockets, fins, ridges, and projecting rough areas.
  5. Apply primer on same day as sheet installation, and allow to dry.
- F. Sheathing Substrates:
  1. Remove dust from substrates by dry brushing.
  2. Apply primer and allow to dry.

#### 3.03 INSTALLATION

- A. General:
  1. Precut pieces of sheet to required size for proper installation and ease of handling.
  2. Remove release paper and position sheet against substrate.
  3. Press entire surface area of sheet firmly against substrate using 6 inch steel hand roller on flat surfaces, or by burnishing with blunt tool such as back of a utility knife on small areas and corners. Continue operation until entire sheet is well bonded to substrate.
  4. Plan installation generally from bottom to top. Overlap adjacent pieces 2 inches, forming laps that shed water, not dam water.
  5. Roll or burnish laps to ensure complete adhesion.
  6. Apply a bead of mastic on laps and perimeter of sheet.
  7. Seal unavoidable penetrations with mastic.
  8. Do not contaminate substrates to receive sealant with primers, surface conditioner, or self-adhesive sheet material.
  9. Apply mastic on top of sheets, only. Do not apply sheet on top of mastic.
- B. Detailing at Window, Door, Louver, and Other Openings:
  1. Wrap sheet into opening a sufficient distance to ensure contact with the inboard air seal (joint sealant) between the sheet and the frame of the window, door, louver, etc., and to form a back dam against water intrusion.

2. Wrap sheet onto the outside face of the wall as recommended by membrane manufacturer, but in no case less than 3 inches on to face of wall.
- C. Metal Edge:
1. Extend metal edge full width of flashing.
  2. In masonry construction install metal drip edge projecting approximately uniformly beyond exposed face.
  3. Provide 1/4 inch gap between ends of metal drip edge to allow for expansion and contraction.
  4. Set metal drip edge in 2 continuous beads of sealant. If permanent masonry is not placed immediately, weight the metal edge with masonry units until it reaches initial set so as to fully compress the sealant. Do not disturb metal edge until sealant is well set.
  5. Lap self-adhesive flashing on top of metal within mortar joint. Hold membrane back 1/2 to 1 inch from face of masonry.
  6. Protect exposed metal edge from bending or other damage.
- D. Self-Adhesive Wall Membrane:
1. Install over the entire wall surface in accordance with general instructions, above.
  2. Termination Bar: Install termination bar where top of membrane terminates against back-up construction and membrane is otherwise unsupported by mechanical fasteners. Secure bar to back-up with mechanical fasteners at 8 inches on center. Seal outside edge with termination mastic.
  3. Where termination bars occur over gypsum sheathing, ensure that fasteners penetrate backing strip.

#### 3.04 FIELD QUALITY CONTROL

- A. Inspect installation before covering with subsequent construction.
- B. Obtain the Architect's approval of initial installation before proceeding with full-scale production.

#### 3.05 CLEANING AND PROTECTION

- A. Protect adjacent surfaces from contamination by surface conditioners, primers, or residue from bituminous sheet.
- B. Remove spills, stains, or over-application in accordance with manufacturer's recommendations.
- C. Protect installed material from damage. Repair any damage to sheet promptly.
- D. If schedule of construction would unavoidably expose sheet materials to sunlight for more than 30 days, cover materials to avoid exposure to sunlight, unless approved in writing by the Architect and the Manufacturers Representative.

END OF SECTION

## SECTION 07 50 10 - CUTTING AND PATCHING OF EXISTING ROOF COVERING

### PART 1 GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
1. Patching of new penetration in roof coverings.

#### 1.02 SUBMITTALS

- A. Product Data: Submit technical product information, installation instructions, and recommendations for each type of roofing material. Furnish additional information as necessary to demonstrate products comply with project criteria.

#### 1.03 PRODUCT HANDLING

- A. Deliver materials to project site in manufacturer's unopened, sealed containers or packages, with manufacturer's labels intact.
- B. Store materials in weather-protected environment, clear of ground and moisture, in strict accordance with manufacturer's and NRCA recommendations.

### PART 2 PRODUCTS

#### 2.01 ASSEMBLIES AND DETAILS

- A. For cutting and patching back, employ only materials, assemblies, and details that would qualify for manufacturer's 20-year NDL warranty for new work. Where a manufacturer's warranty is currently in force for the existing roof, provide notice to manufacturer and maintain existing warranty in force.
- B. Where a manufacturer's warranty is not currently in force, this specification does not require that a manufacturer's warranty be provided.

#### 2.02 INSULATION

- A. Roof Insulation: Match existing insulation type, number of layers, and thickness.
- B. Crickets, Saddles, and Tapered Edge Strips: Tapered insulation.
- C. Cants:
1. Against wood curbs or parapets: Pressure preservative treated wood.
  2. Elsewhere: Tapered insulation.

### PART 3 EXECUTION

#### 3.01 EXISTING CONDITIONS

- A. Correct substrates that are unacceptable to the installer or the roof membrane manufacturer before starting roofing application.

#### 3.02 GENERAL

- A. No roofing operations shall occur without the presence of the installer's supervisor on site, whether:
1. Demolition.
  2. Installation of insulation and roof covering.
  3. Installation of base flashings.
  4. Installation of wood nailers and blocking specified elsewhere.
  5. Installation of sheet metal flashings specified elsewhere.

#### 3.03 SUBSTRATE PREPARATION

- A. General: Remove trash, debris, grease, oil, water, and contaminants from surface.

- B. Removal Of Existing Roofing: Remove existing roofing, insulation, blocking, etc., as indicated and as necessary to accommodate project requirements.
- C. Penetrations: Ensure that roof curbs, equipment supports, columns, posts, piping, etc., which will penetrate roof are installed in correct locations, and permanently secured.

#### 3.04 VAPOR BARRIER AND INSULATION

- A. Vapor Barrier: Preserve, repair, and restore vapor barrier where encountered prior to installing insulation.
- B. Insulation:
  - 1. Install insulation of total thickness to match existing insulation and to fill voids around penetrations and where patching occurs.
  - 2. Butt insulation units tightly together and trim to fit penetrations and interruptions so that gaps between units and between insulation and adjacent construction do not exceed 1/4 inch.
  - 3. Provide preformed units at drains to ensure positive drainage.
  - 4. Provide crickets on high side of roof curbs and other obstructions.
  - 5. Provide crickets, saddles, and tapered areas where necessary to conform to deck, penetrations, and existing irregularities and to avoid localized areas of ponding.
- C. Installation of Roofing Sheets:
  - 1. Follow manufacturer's recommendations for installation to ensure proper installation of sheet without irregularities such as fishmouths or wrinkles.
  - 2. Place and press sheets during installation to ensure proper adhesion to substrate and adjacent roofing sheet.
  - 3. Comply with manufacturer's recommendations to ensure that joints are solidly adhered and weather-tight.

END OF SECTION

## SECTION 07 72 10 - ROOF PENETRATION ACCESSORIES

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Manufactured curbs.
- B. Flashings for penetrations in roofing membrane.

#### 1.02 REFERENCES

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2019a.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- E. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
- G. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free; 2007 (Reapproved 2018).
- H. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2003.

#### 1.03 SUBMITTALS

- A. Product Data:
  - 1. Provide manufacturer's specifications, standard details, and installation recommendations.
  - 2. Indicate size and spacing of fasteners.
- B. Design Data: Submit schedule indicating each piece of equipment, weight of equipment, and capacity of curb or equipment support.

### PART 2 PRODUCTS

#### 2.01 SUBSTITUTIONS

- A. Refer to Section 01 60 00 - Product Requirements.

#### 2.02 MATERIALS

- A. Steel Sheet for Curbs : Galvanized Steel Sheet: ASTM A653/A653M, minimum G90 coating.
- B. Steel for Structural Supports and Reinforcements: ASTM A36/A36M, hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
- C. Flashings, Counterflashings, and Receivers: Stainless Steel Sheet: ASTM A666, Type 302 or 304. 28 gage (0.0156 inch; 0.4 mm).
- D. Fasteners:
  - 1. For attachment of roof accessories to supporting structure: Hot-dip galvanized, zinc plated or cadmium plated steel, or stainless steel.
  - 2. Concealed fasteners for flashings and receivers: Hot-dip galvanized steel or stainless steel.
  - 3. Exposed fasteners: Stainless steel.
- E. Hot-Dip Galvanizing for fabricated products and hardware: ASTM A123/A123M.
- F. Solder: ASTM B32, 50/50 tin-lead, rosin flux unless recommended otherwise by sheet metal manufacturer.

- G. Pourable Sealer: 2-part pourable urethane sealant..
- H. Bituminous Coating: Asphaltic mastic ASTM D4479/D4479M, Type I.
- I. Insulation: Mineral (Rock or Slag) Fiber Insulation Board; ASTM C612; composed of thermosetting resin binders and semirefractory mineral fibers derived from slag.

### 2.03 MANUFACTURED CURBS

- A. General: Provide curbs and supports for mechanical equipment and appurtenances.
  - 1. Fabricate from galvanized steel sheet, minimum 18 gage, with seams fully welded, ground smooth, and painted with zinc-rich primer.
  - 2. Engineer units to support superimposed gravity and wind uplift loads.
  - 3. Style: Vertical sides (no cant).
  - 4. Slope bottom edges to match slope of roof deck so that top is level when installed.
  - 5. Height of curb to extend not less than 10 inches (254 mm) above roof membrane surface.
- B. Curbs Around Flues and Stacks: Manufactured metal roof curbs in accordance with this Section.
  - 1. Provide clearances required by flue rating and applicable regulations.
  - 2. Provide uninsulated, metal roof curb, unless otherwise required.
  - 3. Height of curb to extend not less than 8 inches (203 mm) above roof membrane surface.
- C. Curbs Around Piping Penetrations: Provide roof curbs.
  - 1. Manufactured metal roof curbs in accordance with this Section.
  - 2. Height of curb to extend as required to comply with Schedule of Vertical Clearances. Where piping does not extend over roof membrane (where vertical clearance is not applicable) provide height of curb to extend not less than 8 inches above roof membrane surface.

### 2.04 VERTICAL PIPING PENETRATIONS SUBJECT TO MOVEMENT (VIBRATION, THERMAL EXPANSION/CONTRACTION)

- A. Typical penetrations:
  - 1. Hot and cold water piping.
  - 2. Chilled water piping.
  - 3. Steam piping.
  - 4. Similar penetrations.
- B. Provide roof curb.
- C. Counterflashing:
  - 1. Single, round penetrations up to 12 inches (305 mm) diameter: SMACNA Figure 4-14A.
  - 2. Multiple, round penetrations up to 12 inches (305 mm) diameter each: SMACNA Figure 4-14B.
  - 3. Maintain not less than 2 inches (51 mm) clear between penetrations.
- D. Provide clearance between curb, penetration, and counterflashing to accommodate expected range of movement.
- E. Fill void inside of curb with mineral wool insulation to depth of slab plus roofing insulation.
- F. Flashing material: Stainless steel.

### 2.05 FLUES AND STACKS

- A. Provide Roof curb.
- B. Counterflashing: SMACNA Figure 4-14A.
  - 1. Seal with sealant recommended by flue manufacturer and suitable for operating temperatures of flue surface. Where surface temperature exceeds capabilities of sealants, provide welded, brazed, or soldered counterflashing around flue to receive bonnet.
- C. Flashing material: Stainless steel.

## 2.06 OTHER PENETRATIONS AND CONDITIONS

- A. At conditions not scheduled or otherwise indicated, provide roofing membrane manufacturer's standard prefabricated thermoplastic or elastomeric boot or liquid flashing or provide curbs and flashings in accordance with SMACNA standard details and recommendations, and fabricated of the materials specified herein.

## 2.07 SCHEDULE OF VERTICAL CLEARANCES

- A. Fabricate equipment supports and pipe supports to provide not less than the following distances. W=width of equipment. H=height measured from roof membrane surface to underside of equipment.
  1. W less than 25 inches (620 mm): H=14 inches (356 mm).
  2. W 25 inches (620 mm) to less than 37 inches (940 mm): H=18 inches (457 mm).
  3. W 37 (940 mm) to less than 49 inches (1245 mm): H=24 inches (610 mm).
  4. W 49 inches (1245 mm) or greater: H=48 inches (1219 mm).

## 2.08 FLASHING FABRICATION

- A. Shop fabricate flashings, counterflashings, receivers, sleeves, bonnets, and other sheet metal items to the greatest extent practicable.
- B. Soldering:
  1. Soldered joints are required for all joints except between two-piece receiver and counterflashing. Sealant joints are not acceptable substitutes for soldered joints. Sealant shall be installed between sheet metal fabrications and adjacent construction, not as a means of fabricating sheet metal.
  2. Clean surfaces to be soldered, removing oils and foreign matter.
  3. Pretin edges of sheets to be soldered to a width of 1-1/2 inches, except where pretinned surface would show in the finished work.
  4. Do not use torches for soldering.
  5. Heat surfaces to receive solder and flow solder into joint. Fill joint completely.
  6. Completely remove flux and spatter from exposed surfaces.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that substrates and openings are rigidly set, at proper lines and elevation, properly sized, and ready to receive units.
- B. Do not proceed with installation until conditions detrimental to proper installation have been corrected.
- C. Coordinate installation with roofing work and other adjacent elements of building envelope to ensure watertight construction.

### 3.02 DISTANCE BETWEEN PENETRATIONS

- A. Coordinate and layout mechanical, electrical, and structural work to provide clearance between penetrations as follows:
  1. Distance between curb and adjacent curb: Not less than 20 inches (508 mm).
  2. Distance between curb and adjacent wall or equipment extending more than 36 inches (914 mm) above roof: Not less than 36 inches (914 mm).
  3. Distance between stripped-in roof jacks and adjacent curbs, parapets, or walls: Not less than 18 inches (457 mm).
  4. Distance between stripped-in jacks: Not less than 12 inches (305 mm).
- B. If the Contract Documents appear to indicate clearances less than above, obtain instructions from the Architect before proceeding with layout and coordination. Do not construct clearances less than above without the approval of the Architect. If clearances less than above have been constructed without the express approval of the Architect, reconstruct clearances without change in Contract Time or Price.

### 3.03 INSTALLATION

- A. Install products in accordance with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.
- B. Install products in correct location, plumb and true, without warp or twist.
- C. Secure curbs and equipment supports to structure, and equipment to curbs, in accordance with manufacturer's instructions to prevent wind uplift forces specified. Do not install curbs or equipment supports on top of roofing insulation or nailers unless specifically approved.
- D. Isolate dissimilar metals by means of a heavy bituminous coating, approved paint coating, adhered polyethylene sheet, or other means approved by the Architect.

### 3.04 SEALING OF ENVELOPE

- A. General: Install sealant to form a water-tight and air-tight seal between penetrating elements and building envelope.
- B. Where roof deck is indicated to be a fire-resistance-rated assembly, install firestopping between penetrating elements and deck. Firestopping is specified elsewhere in Division 7.
- C. Where roof deck is not indicated to be a fire resistance rated assembly:
  - 1. Fill void between penetration and deck with mineral wool insulation and install pourable sealant to seal between penetrating element and deck.
  - 2. Where curbs are not used, install pourable sealant up to top of sheet metal flashing.
  - 3. Exception: Where prohibited by flue or stack clearance requirements.

### 3.05 CLEANING AND PROTECTION

- A. Touch up marred or abraded areas of finished elements. If satisfactory touch-up cannot be accomplished, remove and replace element.

### 3.06 SMACNA FIGURES

- A. See the SMACNA "Architectural Sheet Metal Manual" for additional material, fabrication, and joining requirements.

END OF SECTION



## SECTION 07 84 00 - FIRESTOPPING

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Protection of new and existing fire-resistance-rated construction and smoke barriers as required by the building code, and using materials subject to the limitations of this specification.
  - 1. Protection of new penetrations and construction.
  - 2. Inspection of existing penetrations and construction uncovered during the course of construction.
  - 3. Repair/renewal of non-compliant existing penetrations and construction where encountered.
- B. The location and extent of fire-resistance-rated construction and smoke barriers are indicated on the Drawings.
  - 1. Protect every penetration into or through such construction.
  - 2. Protect every joint in such construction or between elements of such construction and adjacent construction.
- C. Work Not Included: Repairing penetrations made in error and repairing penetrations which are too large to be sealed by the methods indicated; these are to be repaired using the original material of the construction.

#### 1.02 PRICE AND PAYMENT

- A. Include the cost of firestopping new penetrations and construction in the base bid.
- B. Include the cost of firestopping of existing penetrations and construction in the base bid where shown on the drawings, schedules, or specifications.
- C. The cost of repair or renewal of non-compliant existing firestopping penetrations and construction encountered during construction will be paid for in accordance with the General Conditions that govern changes in the Work.

#### 1.03 REFERENCES

- A. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).
- B. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestops; 2018.
- C. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2015b, with Editorial Revision (2016).
- D. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2010a (Reapproved 2015).
- E. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).
- F. FM P7825 - Approval Guide; current edition.
- G. ITS (DIR) - Directory of Listed Products; current edition.
- H. UL (FRD) - Fire Resistance Directory; Current Edition.
- I. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.
- J. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

#### 1.04 DEFINITIONS

- A. Fire Wall, Fire Barrier, Smoke Barrier, Fire Partition: As defined by the building code.

#### 1.05 SUBMITTALS

- A. Product Data: Provide data on product characteristics, performance ratings, limitations, and tested assembly details including preparation and installation instructions.
- B. Shop Drawings - Schedule: Submit a single, integrated, and complete list of joints and penetrations to be sealed including penetrations caused by mechanical, electrical, plumbing, and other work. Do not submit separate schedules prepared by the various subcontractors. Identify the following:
  - 1. Type of penetration (floor, wall, other).
  - 2. Fire rating of penetrated assembly.
  - 3. Material of penetrated assembly (e.g., cast-in-place concrete wall, CMU wall, composite floor deck, etc.).
  - 4. Size and material of the penetrating object (e.g. 4"-8" C.I.P, EMT up to 2" dia., etc.).
  - 5. Testing laboratory design number.
  - 6. Manufacturer's design number.
- C. Preinstallation Inspection Report.
- D. Final Inspection Report.

#### 1.06 QUALITY ASSURANCE

- A. Manufacturer's technical representative shall be available for initial job start-up and trouble-shooting as needed, and to assist with inspections.
- B. Coordination Meeting: Prior to the start of work which involves cutting penetrations, conduct a meeting with installers of such work to identify fire barriers and required configurations of penetrations and to discuss the proper procedures and time schedule for cutting, patching, and sealing penetrations in such assemblies, with emphasis on avoiding unnecessary cutting and patching.

#### 1.07 REGULATORY REQUIREMENTS

- A. Protect fire rated construction and smoke barriers as required by the building code, and using materials subject to the limitations of this specification. Construction to be protected includes:
  - 1. Penetrations into or through fire walls, fire barriers, smoke barriers, and fire partitions.
  - 2. Penetrations into or through fire-resistance-rated floors, floor/ceiling assemblies, and the ceiling membrane of roof/ceiling assemblies.
  - 3. Penetrations in smoke barriers.
  - 4. Joints in or between fire-resistance-rated walls, floors, floor/ceiling assemblies, roofs, and roof/ceiling assemblies.
  - 5. Joints between fire-resistance-rated floor or floor/ceiling assemblies and exterior curtain wall assemblies (where a curtain wall is formed by wall materials that bypass the floor slab edge such as aluminum framing and glass, studs and other cladding, or other wall materials).
  - 6. Joints in smoke barriers.
  - 7. Joints at the intersection of horizontal smoke barriers and exterior curtain wall assemblies.
  - 8. Penetrations into or through non-fire-resistance-rated floors, floor/ceiling assemblies, and the ceiling membrane floor/ceiling assemblies.

#### 1.08 MOCK-UP

- A. Install one mock-up of each major type of firestop assembly using proposed materials and illustrating workmanship to be expected in the completed work.
- B. Obtain approval of the manufacturer's technical representative before proceeding with firestopping work.
- C. Disassembly or removal may be required during inspection.

#### 1.09 PROJECT CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation.

- B. Provide ventilation in areas where solvent-cured materials are being installed.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project site in original unopened containers bearing the name of the manufacturer, product name, type, and testing agency's identification mark.
- B. Store products in accordance with manufacturer's instructions.

#### 1.11 SEQUENCING AND SCHEDULING

- A. Perform firestopping work after completion of work which penetrates fire barriers, but prior to covering up or eliminating access to the penetration. Coordinate with installers of such other work.

### PART 2 PRODUCTS

#### 2.01 SUBSTITUTIONS

- A. Refer to Section 01 60 00 - Product Requirements.

#### 2.02 MANUFACTURERS

- A. Fire Testing of Assemblies: Provide materials and designs that have been tested by approved agencies, as follows:
  1. Listing in the current-year classification or ITS (DIR), FM P7825, or UL (FRD) will be considered as constituting an acceptable test report.
  2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at [www.icc-es.org](http://www.icc-es.org) will be considered as constituting an acceptable test report.
- B. Provide products complying with requirements of the contract documents and made by a single manufacturer to the greatest extent practicable, unless otherwise indicated and approved by the Architect.

#### 2.03 MATERIALS

- A. Firestopping Materials: Provide assemblies whose fire-resistance ratings have been determined by testing in the configurations required and which have fire-resistance ratings at least as high as that of the fire-rated assembly in which they are to be installed.
  1. If a tested assembly is not available for a particular penetration or joint configuration, modify the penetration or joint configuration to suit available assemblies; do not modify assembly configuration except as specifically stated in the test report or as approved by the authority having jurisdiction.
  2. Provide products that:
    - a. Allow normal expansion and contraction movement of the assembly without failure of the seal.
    - b. Emit no hazardous, combustible, or irritating by-products during installation or curing period.
    - c. Do not require special tools for installation.
  3. Provide products that allow for differential movement unless otherwise approved.
  4. For products used in horizontal assemblies, provide products that are impervious to water when fully cured.
  5. For materials used in expansion joints, provide sealant with at least 40% movement capability in compression or extension. For other joints provide at least 25% movement capability in compression or extension.
  6. Select assemblies and products so as to minimize the number of different assemblies and different products used.
- B. Penetration Assembly Labels: Permanent, red marking with black lettering.
  1. For marking firestopping assemblies, use self-adhesive tape or wired-on labels.
  2. Legend:
    - a. Fire-Rated Assembly - Do not disturb - See maintenance instructions".
    - b. Product manufacturer's name.

- c. U.L. Des. No. \_\_\_\_\_
- d. F rating: \_\_\_\_\_
- e. T rating: \_\_\_\_\_
- f. Installer's name.

C. Partition Labels:

- 1. Permanent, red lettering with legend "\_ HOUR RATED FIRE AND SMOKE BARRIER - PROTECT ALL OPENINGS".
- 2. Use letters at least 3 inches (77 mm) high.

2.04 ASSEMBLIES

- A. Protect fire rated construction and smoke barriers as required by the building code, and using materials subject to the limitations of this specification.
  - 1. Exceptions: Certain materials, locations, and assemblies are exempt where permitted by the building code and approved by the authorities having jurisdiction.
- B. Penetrations into or through fire walls, fire barriers, smoke barriers, and fire partitions: Provide through-penetration firestop systems tested per ASTM E814 or UL 1479, minimum positive pressure differential of 0.01 inch of water, F rating not less than that of the wall.
- C. Penetrations into or through fire-resistance-rated floors, floor/ceiling assemblies, and the ceiling membrane of roof/ceiling assemblies: Provide through-penetration firestop systems tested per ASTM E814 or UL 1479, minimum positive pressure differential of 0.01 inch of water, F rating and T rating not less than that of the floor nor less than 1 hour whichever is greater.
- D. Penetrations in smoke barriers: Provide through-penetration firestop systems tested per UL 1479 for air leakage. The L rating measured at 0.30 inch of water in ambient and elevated temperature tests: Not greater than 5.0 CFM/SF of penetration opening for each penetration or a total leakage of 50 CFM for any 100 SF of wall area or floor area.
- E. Joints in or between fire-resistance-rated walls, floors, floor/ceiling assemblies, roofs, and roof/ceiling assemblies: Provide fire-resistant joint systems tested per ASTM E1966 or UL 2079.
- F. Joints between fire-resistance-rated floor or floor/ceiling assemblies and exterior curtain wall assemblies (where a curtain wall is formed by wall materials that bypass the floor slab edge such as aluminum framing and glass, studs and other cladding, or of other wall materials): Provide an approved system tested per ASTM E2307, F rating not less than that of the floor.
- G. Joints in smoke barriers: Provide fire-resistant joint systems tested per UL 2079 for air leakage. The L rating measured at 0.30 inch of water in ambient and elevated temperature tests: Not greater than 5 CFM/LF.
- H. Joints at the intersection of horizontal smoke barriers and exterior curtain wall assemblies: Provide fire-resistant joint systems tested per UL 2079 for air leakage. The L rating measured at 0.30 inch of water in ambient and elevated temperature tests: Not greater than 5 CFM/LF.

2.05 ACCESSORIES

- A. Primers, Sleeves, Forms, and Accessories: Type required for tested assembly design.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Preinstallation Inspection:
  - 1. Inspect for penetrations of any type; mark or otherwise identify all penetrations indicating action required: "Repair" or "Firestop".
  - 2. Conduct inspection prior to covering up or enclosing walls or ceilings.
  - 3. Conduct inspection jointly with authorized representative of authority having jurisdiction, unless the authority waives the inspection.
  - 4. Submit a report detailing findings of inspection to the Architect.

- B. Include existing penetrations uncovered during the course of construction in the preinstallation inspection.
- C. If the configuration of a particular penetration does not conform to the configuration necessary for the required firestopping assembly, modify the construction to suit the firestopping assembly design.

### 3.02 PREPARATION

- A. Prepare penetrations in accordance with material manufacturer's instructions.
- B. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.
- C. Remove incompatible materials which may affect bond.

### 3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings. Provide all accessory materials required.
- B. Produce a smooth, uniform, neat appearing finish.
- C. Remove combustible forming materials, unless they are a required component of the tested assembly.
- D. Do not cover installed firestopping until inspected by authority having jurisdiction, unless such inspection is waived by the authority.

### 3.04 PERMANENT IDENTIFICATION

- A. Affix penetration assembly labels to each fire-stop penetration assembly.
- B. Install partition labels on fire rated partitions above lay-in ceilings at intervals not exceeding 12 feet.

### 3.05 FIELD QUALITY CONTROL

- A. Special inspections are required by the building code or by the authority having jurisdiction. Inspections shall be conducted in accordance with ASTM E2174 and ASTM E2393 by an approved inspection agency acceptable to the authority having jurisdiction.
  - 1. The Owner will pay for the cost of one such inspection. The cost of additional inspections, if required, will be deducted from the Contract Price in accordance with the General Conditions.
- B. Special Inspections: Coordinate and schedule special inspections by the approved inspection agency.
- C. Inspect completed installations for completeness and correct installation.
  - 1. Arrange for the firestopping material manufacturer's representative to conduct an inspection of completed work.
  - 2. If installed work is to be covered in completed work, inspect and obtain approval prior to covering.
- D. Submit report of inspection to the Architect.
- E. Notify the Architect of completed firestopping work prior to covering with subsequent work.

### 3.06 CLEANING AND PROTECTION

- A. Clean adjacent surfaces of excess firestopping materials promptly. Use methods and materials approved by the manufacturers of the penetration seals and of surfaces to be cleaned.
- B. Protect adjacent surfaces from damage by material installation.
- C. Protect installed work during curing period.
- D. Protect installed work from damage from construction operations using substantial barriers, if necessary.

- E. Repair damaged firestopping and adjacent materials in accordance with manufacturer's instructions.

END OF SECTION

SECTION 07 92 00 - JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Section Includes:
  - 1. Sealants and joint backing.
- B. Work of this section includes:
  - 1. Sealing of joints indicated in the schedule at the end of this section and in other locations required by the Contract Document.
  - 2. Seal joints in exterior envelope to prevent the entry or escape of water or air.
  - 3. Seal joints on the interior of the building to prevent the passage of water or air from space to space or between adjacent building materials and assemblies.
  - 4. Joints of a nature similar to that of joints indicated shall be sealed with same sealer, whether or not specifically indicated on the drawings and schedules to be sealed.

1.02 REFERENCES

- A. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

1.03 DEFINITIONS

- A. M Type Substrates: Cast-in-place concrete, concrete masonry units, clay brick, masonry mortar, natural stone.
- B. G Type Substrates: Glass and transparent plastic glazing sheets.
- C. A Type Substrates: Metals, porcelain, glazed tile, and smooth plastics.
- D. O Type Substrates: Wood, unglazed tile; substrates not included under other categories.
- E. Use T: Surfaces bearing pedestrian or vehicular traffic.
- F. Use NT: Non-traffic-bearing surfaces.

1.04 SUBMITTALS

- A. Product Data:
  - 1. Provide manufacturer's data on each joint sealer indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, color availability, and installation instructions.
  - 2. Provide manufacturer's technical guide containing recommendations for primers for each exterior sealant/substrate combination.
- B. Samples: Submit two cured samples for each product exposed to view, illustrating full range of sealant colors available for selection.
- C. Test Reports:
  - 1. Field installation test reports for each joint sealer.
- D. Installer's Preconstruction Inspection Report: List all conditions detrimental to performance of joint sealer work.
- E. Warranty.

1.05 MOCK-UP

- A. Before beginning installation, install sealers in joints in actual construction as directed by the Architect, to show color, materials, and installation.
- B. Locate where directed.
- C. Keep mock-ups intact as the standard for evaluating the completed joint sealer work.
- D. Mock-up may remain as part of the Work.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original containers or bundles with labels showing manufacturer, product name or designation, color, shelf life, and installation instructions.

#### 1.07 PROJECT SITE CONDITIONS

- A. Environmental Limitations: Do not install sealers if any of the following conditions exist:
  - 1. Air or substrate temperature exceeds the range recommended by sealer manufacturer or is below 40 degrees F (4.4 degrees C) or is above 100 degrees F (38 degrees C).
  - 2. Substrate is wet, damp, or covered with snow, ice, or frost.
  - 3. Substrate is dusty, oily, or otherwise contaminated.
- B. Dimensional Limitations: Do not install sealers if joint dimensions are less than or greater than that recommended by sealer manufacturer; notify the Architect and get joint sealer manufacturer's recommendations for alternative procedures.
- C. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

#### 1.08 WARRANTY

- A. Submit a written warranty signed by the Contractor guaranteeing to correct failures in joint sealer work within a five year period after Date of Substantial Completion, without reducing or otherwise limiting any other rights to correction which the Owner may have under the contract documents. Failure is defined as failure to remain weathertight due to faulty materials or workmanship. Correction is limited to replacement of sealers.

### PART 2 PRODUCTS

#### 2.01 SUBSTITUTIONS

- A. Refer to Section 01 60 00 - Product Requirements.

#### 2.02 SEALANTS

- A. High Movement Silicone Sealant: One- or two-part, non-acid-curing, ASTM C920, Grade NS, Class 25, Use NT, plus movement capability of 50 percent in extension, 50 percent in compression.
  - 1. Products:
    - a. Dow Chemical Company; Dowsil 756SMS, 790, or 795: [www.dowcorning.com](http://www.dowcorning.com). (60 g/l), (26 g/l), (32 g/l)
    - b. Momentive GE Silicones: SCS 2000 SilPruf Sealant or SCS2700 SilPruf LM Sealant; (20 g/l), (27 g/l); [www.siliconeforbuilding.com](http://www.siliconeforbuilding.com).
    - c. Pecora Corporation; 890NST: [www.pecora.com](http://www.pecora.com). (98 g/l)
    - d. Sika Corporation: Sikasil WS-290 or WS-295; (29 g/l), (37 g/l); [usa.sika.com](http://usa.sika.com).
- B. Mildew-Resistant Silicone Sealant: One-part, ASTM C920, Type S, Grade NS, Class 25, Use NT, formulated with fungicide, for interior use on nonporous substrates.
  - 1. Products:
    - a. Dow Chemical Company; Dowsil 786: [www.dowcorning.com](http://www.dowcorning.com). (36 g/l)
    - b. Momentive GE Silicones: SCS1700 Sanitary; [www.siliconesforbuilding.com](http://www.siliconesforbuilding.com). (20 g/l)
    - c. Pecora Corporation; 860: [www.pecora.com](http://www.pecora.com). (12 g/l)
- C. Butyl Sealant:
  - 1. ASTM C920, Grade NS, Class 12-1/2, Uses NT; single component, solvent release, nonskinning, nonsag.
- D. One-Part Nonsag Urethane Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT.
  - 1. Products:
    - a. Master Builders / BASF ; MasterSeal NP 1: [www.master-builders-solutions.basf.com](http://www.master-builders-solutions.basf.com). (35 g/l)
    - b. Pecora Corporation; Dynatrol I-XL: [www.pecora.com](http://www.pecora.com). (68 g/l)



- c. Sika Corporation; Sikaflex 1a: [www.sika.com](http://www.sika.com). (47.6 g/l)

### 2.03 ACCESSORIES

- A. Primer for Silicone Sealants: Nonstaining type, as recommended by joint sealant manufacturer for specific substrates encountered on the project and as verified by testing.
- B. Joint Cleaner: Noncorrosive and nonstaining type, recommended by sealant manufacturer; not damaging to substrates, and compatible with joint forming materials.
- C. Backer Rods: Flexible, nonabsorbent, compressible polyethylene foam, either open cell or nongassing closed cell, unless otherwise restricted by sealant manufacturer; preformed to appropriate size and shape.
- D. Bond-Breaker Tape: Self-adhesive, polyethylene or other plastic tape, unless otherwise restricted by sealant manufacturer; suitable for preventing sealant adhesion.
- E. Masking Tape: Nonabsorbent, nonstaining.
- F. Tooling Agents: Approved by sealant manufacturer; nonstaining to sealant and substrate.

### 2.04 SEALANT COLORS

- A. The Architect will select sealant colors from manufacturer's full range of available colors for each respective sealant and adjacent substrate.
- B. Obtain approval of mock-up color before ordering job quantities of sealant.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Examine joints for characteristics that may affect sealer performance, including configuration and dimensions.
- B. Verify that joint backing and release tapes are compatible with sealant.

### 3.02 PREPARATION

- A. Cleaning: Just before starting sealer installation, clean out joints as follows:
  - 1. Remove loose materials and foreign matter which might impair adhesion of sealant including, but not limited to, dust, dirt, coatings, paint, oil, and grease.
  - 2. Dry out damp and wet substrates thoroughly.
  - 3. Clean A-type and G-type substrates by chemical or other methods that will not damage the substrate.
  - 4. Remove loose particles by brushing and by blowing with oil-free compressed air.
  - 5. Concrete: Remove laitance and form-release coatings.
  - 6. Use methods which will not leave residues that will impair adhesion.
- B. Prime joint substrates where required by this specification, manufacturer's recommendations, or adhesion tests.
- C. Masking Tape: Use masking tape to keep primers and sealers off of adjacent surfaces which would be damaged by contact or by cleanup. Remove tape at the end of each day.
- D. Protect elements surrounding the work of this section from damage or disfigurement.
- E. Install fillers where needed to provide proper joint depth or support for sealant backers.
- F. Do not begin joint sealer work until unsatisfactory conditions have been corrected.

### 3.03 INSTALLATION

- A. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- B. Comply with sealer manufacturer's installation instructions and recommendations, except where more restrictive requirements are specified.
- C. Gunnable and Pourable Sealants: Comply with recommendations of ASTM C1193.
- D. Backers:

1. Install backers at depth required to result in shape and depth of installed sealant which allows the most joint movement without failure.
    - a. Make backers continuous, without gaps, tears, or punctures.
    - b. Do not stretch or twist backers.
  2. Use bond-breaker tape wherever it is necessary to keep sealant from adhering to back or third side of joint.
  3. If backers become wet or damp before installation of sealant, dry out thoroughly before proceeding.
- E. Shape and Depth: Use methods recommended by manufacturer; completely fill the joint; make full contact with bond surfaces; tool nonsag sealants to smooth surface eliminating air pockets.
1. Use concave joint shape shown in Figure 8 in ASTM C1193, where not otherwise indicated.
  2. Depth of sealant at center of joint, unless otherwise required by the Contract Documents or recommended by manufacturer:
    - a. For joints up to 1/4 inch (6.4 mm) wide: Depth equal to width.
    - b. For joints 1/4 inch to 1/2 inch (13 mm) wide: Depth equal to 1/4 inch.
    - c. For joints over 1/2 inch (13 mm) wide: Depth equal to 1/2 the width but not deeper than 1/2 inch.
  3. Contact depth: Twice the depth of sealant at center of joint, unless otherwise required.

#### 3.04 CLEANING

- A. Clean adjacent soiled surfaces adjacent to joints as work progresses and before sealants set using methods and materials approved by manufacturers of sealers and of surfaces to be cleaned.

#### 3.05 PROTECTION OF FINISHED WORK

- A. Protect sealants from contamination and damage until cured.
- B. Remove and replace damaged sealers.

#### 3.06 FIELD INSTALLATION TESTS:

- A. Before installation, install samples and test the adhesion of each type of sealers to each type of actual substrates. Do initial field adhesion hand-pull tests in the presence of the sealant manufacturer's representative. Report results.
- B. Field Tests on Installed Sealants: Perform periodic tests for each combination of exterior sealer and substrate.
  1. Perform tests at a rate of ten tests for the first 1,000 feet. Thereafter, for each type of sealant being installed on each substrate perform one test per 2,500 square feet thereafter, or one test per floor per elevation, whichever is greater. Record the test results in a field adhesion test log.
- C. For each type of sealant, obtain specific test procedure and pass/fail criteria from sealant manufacturer.
- D. Field Test as described in ASTM C1193 Appendix X1.1 - Method A, Field-Applied Sealant Joint Hand Pull Tab:
  1. Seal at least 5 foot (1.5 m) lengths of joints and cure properly.
  2. Perform each test at the job site after the sealant is fully cured.
  3. Make a knife cut horizontally from one side of the joint to the other.
  4. Make two vertical cuts, from the horizontal cut, approximately 3" (76 mm) long, at both sides of the joint.
  5. Place a 1 inch (25 mm) mark on the sealant tab.
  6. Grasp the 2 inch (51 mm) piece of sealant firmly just beyond the 1 inch (25 mm) mark and pull at a 90 degree angle.
  7. If dissimilar substrates are being sealed, check the adhesion of sealant to each substrate separately. This is accomplished by extending the vertical cut along one side of the joint, checking adhesion to the opposite side, and then repeating for the other side.

8. Pass criteria: When extended to its rated value, sealant remains intact or sealant tears in cohesion. Fail criteria: Before or at extension to its rated value, sealant releases from either substrate.
9. Inspect the joints for complete fill. The joints should not have voids, and joint dimensions indicated.
10. Repair the sealant pulled from the test area by applying new sealant to the test area. Care should be taken to ensure that the original sealant surfaces are clean and that the new sealant is in contact with the original sealant.

E. Report results.

3.07 SCHEDULE

A. General:

1. Seal joints in exterior envelope to prevent the entry or escape of water or air.
2. Seal joints on the interior of the building to prevent the passage of water or air from space to space or between adjacent building materials and assemblies.
3. Joints of a nature similar to that of joints indicated shall be sealed with same sealer, whether specifically indicated on the drawings and schedules to be sealed or not.

B. Typical Exterior Joints:

1. Including, but not limited to:
  - a. Wall joints.
  - b. Joints around perimeter of frames.
  - c. Exterior joints for which no other sealer is indicated.
2. Use high movement silicone sealant unless otherwise indicated.

C. Metal Flashings:

1. Including, but not limited to:
  - a. Joints in flashing, gravel stops, fascia, and coping and between them and adjacent construction.
  - b. Where flashing is inserted into reglet in wall, and top edge of surface mounted reglets.
2. Use high movement silicone sealant.

D. Exterior Door Thresholds: Set thresholds in butyl sealant.

E. Typical Interior Joints:

1. Including, but not limited to:
  - a. Between walls or partitions and adjacent casework, laboratory furniture, fixed shelving, fixed equipment, lighting fixtures, laboratory piped utility fittings.
  - b. Between concrete or masonry or other material and the perimeters of frames of doors, windows, access panels, etc. (Note: Sealing of gypsum panel/metal stud construction is specified in Section 09 21 16.)
  - c. Between hollow metal jambs and resilient flooring.
  - d. Between concrete or masonry walls or partitions and adjacent columns, pilasters, walls, partitions, floors, ceilings, or other construction.
  - e. Interior joints for which no other sealer is indicated.
2. Use the following sealant:
  - a. One part, nonsag urethane sealant.

F. Joints in Interior Wet Areas:

1. Including, but not limited to:
  - a. Breakrooms.
  - b. Between walls or other surfaces and adjacent plumbing fixtures, fittings, and casework.
2. Use the following sealants:
  - a. Mildew-resistant silicone sealant.

END OF SECTION



## SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Work Included in this Section:
  - 1. Steel Doors:
    - a. Non-fire-resistance rated exterior steel doors.
    - b. Thermally insulated steel doors.
  - 2. Steel Frames:
    - a. Non-fire-resistance rated interior steel frames.
    - b. Non-fire-resistance rated exterior steel frames.
    - c. Fire-resistance rated interior steel frames.
    - d. Steel frames for glazed lights, interior transoms, and panels.

#### 1.02 REFERENCES

- A. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.
- B. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2019a.
- D. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.
- E. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; 1993; also in WDHS-1/WDHS-5 Series, 1996.

#### 1.03 SUBMITTALS

- A. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
- B. Shop Drawings: Details of each opening showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

#### 1.04 QUALITY ASSURANCE

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

#### 1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

### PART 2 PRODUCTS

#### 2.01 SUBSTITUTIONS

- A. Refer to Section 01 60 00 - Product Requirements.

#### 2.02 GENERAL

- A. Requirements for All Units:
  - 1. Door Top Closures: Flush with top of faces and edges.
  - 2. Door Edge Profile: Beveled on both edges.
  - 3. Door Texture: Smooth faces.
- B. Hardware Preparation: In accordance with DHI (LOCS) and DHI WDHS.3, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
- C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the

requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

### 2.03 STEEL DOORS

- A. Thickness: 1-3/4 inches unless indicated otherwise.
- B. Exterior Doors, Non-Fire-Rated:
  - 1. Grade: ANSI/SDI A250.8 Level 2, 18 ga., physical performance Level B, Model 1, full flush.
  - 2. Core: Polyurethane.
  - 3. Top Closures: Flush with top of faces and edges.
  - 4. Galvanized.
  - 5. Texture: Smooth faces.
  - 6. Weatherstripping: Integral, recessed into door edge or frame.

### 2.04 STEEL FRAMES

- A. General:
  - 1. Comply with the requirements of grade specified for corresponding door.
  - 2. Frames for Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 1, 16 gage
  - 3. Finish: Same as for door.
  - 4. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.
  - 5. Frames Wider than 48 Inches: Reinforce with steel channel fitted tightly into frame head, flush with top.
- B. Exterior Door Frames: Face welded, seamless with joints filled.
  - 1. Weatherstripping: Separate, see Door Hardware section.
- C. Interior Door Frames, Non-Fire-Rated:
  - 1. Gypsum board partitions. Fully welded.
- D. Interior Door Frames, Fire-Rated:
  - 1. Gypsum board partitions. Fully welded.
  - 2. Fire Rating: Same as door, labeled.
- E. Mullions for Pairs of Doors: Removable type, of profile similar to jambs.
- F. Frames for Interior Glazing or Borrowed Lights: Construction and face dimensions to match door frames, and as indicated on drawings.
- G. Transom Bars: Fixed, of profile same as jamb and head.

### 2.05 ACCESSORY MATERIALS

- A. Glazing:
  - 1. As specified in Section 08 80 00.
- B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- C. Astragals for Double Doors: Specified in Door Hardware section.
- D. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.
- E. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

### 2.06 FINISH MATERIALS

- A. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A60/ZF180 coating. Factory-prime galvanized units.
  - 1. Galvanize exterior units.
- B. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- C. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.

3.02 INSTALLATION

- A. Install in accordance with the requirements of the specified door grade standard.
- B. Coordinate frame anchor placement with wall construction.
- C. Coordinate installation of hardware.
- D. Coordinate installation of glazing.

3.03 ERECTION TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.04 ADJUSTING

- A. Adjust for smooth and balanced door movement.

END OF SECTION





## SECTION 08 14 16 - FLUSH WOOD DOORS

### PART 1 GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
1. Factory finishing.
  2. Prefitting by manufacturer.
  3. Premachining by manufacturer.

#### 1.02 REFERENCES

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).  
B. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2013.

#### 1.03 SUBMITTALS

- A. Product Data: Submit detailed technical information for each distinct product specified in this section. Include complete data for factory finished doors.
- B. Shop Drawings: Prepare and submit shop drawings showing relevant information, including:
1. Construction details for each distinct product type.
  2. Dimensions and location of blocking for hardware.
  3. Factory finishing details.
- C. Samples: Submit samples for the following:
1. Factory finishes:
    - a. Verification samples: Minimum 8-inch-square sample for each color, effect, and type of factory finish.
- D. Certificates:
1. Submit certification that manufacturer's construction standards and tested fire door assembly requirements comply with contract requirements indicated for doors, hardware, hardware templating, size of lights, and other design characteristics.
    - a. Clearly note any exceptions to certification, citing door number and hardware set. Exceptions shall be subject to the approval of the Architect.

#### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products as required to prevent damage or deterioration. Conform to manufacturer's recommendations, requirements of referenced standard, and recommendations of WDMA I.S. 1A, Appendix, "How to Store, Handle, Finish, Install, and Maintain Wood Doors."
- B. Clearly label each door with opening number where door will be installed. Use removable, temporary labels or mark on door surface which will be concealed from view after installation.
1. Coordinate door identification with shop drawing designations.
- C. Environmental Requirements: Do not deliver, store, or install products of this section before building's design temperature and humidity levels have been achieved and will be maintained at those levels.

#### 1.05 WARRANTIES

- A. Manufacturer's Warranty (Interior Doors):
1. Submit a written warranty signed by the manufacturer guaranteeing to correct failures in products which occur within the warranty period indicated below, without reducing or otherwise limiting any other rights to correction which the Owner may have under the contract documents. Failures are defined to include:
    - a. Faulty workmanship.
    - b. Delamination.
    - c. Stile, rail, or core show-through (telegraphing) visible to the naked eye to any degree when viewed from a horizontal distance of 3 to 4 feet.

- d. Warp (including bow, cup, and twist) in excess of 1/4 inch when measured in accordance with WDMA I.S. 1A.
  2. Correction includes repair or replacement at the option of the Architect. Correct failures which occur within the following warranty periods after Substantial Completion:
    - a. Solid core interior doors: Life of original installation.
- B. If, for any reason, the Contractor's work results in nullification of manufacturer's warranty, the Contractor shall correct failures and pay for such correction.

## PART 2 PRODUCTS

### 2.01 SUBSTITUTIONS

- A. Refer to Section 01 60 00 - Product Requirements.

### 2.02 WOOD DOORS - GENERAL REQUIREMENTS

- A. Flush Doors: Conform to one of the following:
1. WDMA I.S. 1A: "Industry Standard for Interior Architectural Wood Flush Doors".
  2. AWI/AWMAC/WI (AWS) "Architectural Woodwork Standards".

### 2.03 CONSTRUCTION

- A. Faces: match existing
1. Veneer species, cut, and grade for transparent finish (HPVA standards):
    - a. White (sap) Maple, Plain Sliced.
- B. Construction: PC-5 (5-ply).
- C. Core, Non-Fire-Rated Doors: Particleboard, bonded to stiles and rails, sanded.
- D. Door Thickness: 1-3/4" unless indicated otherwise.
- E. Glue: Type I.

### 2.04 FABRICATION

- A. General:
1. Fabricate to provide consistent clearances as indicated.
  2. Hinge and lock edges:
    - a. Provide 1/8-inch standard bevel at edges, unless standard bevel would not precisely match hardware bevel; provide proper bevel for hardware.
  3. Make neat mortises and cutouts for door hardware indicated.
  4. Prefitting: Fabricate and trim doors to size at factory to coordinate with frame shop drawings and floor finishes as indicated in the finish schedule.
    - a. Provide non-standard clearances and tolerances indicated in Part 3.
  5. Premachining: Make all mortises and cutouts required for hardware at the factory to conform to approved hardware schedule, hardware templates, and door frame shop drawings.

### 2.05 FACTORY FINISHING

- A. Comply with one of the following:
1. AWI/AWMAC/WI (AWS) Section 5, "Factory Finishing".
  2. WDMA I.S. 1A "Finishing".
- B. Transparent Finish:
1. WDMA I.S. 1A System TR-6 Catalyzed Polyurethane or TR-8 UV Cured Acrylated Polyester/Urethane.
  2. AWI/AWMAC/WI (AWS) AWI System 11 Catalyzed Polyurethane or System 9 UV Cured Acrylated Polyester/Urethane.
  3. Sheen: Satin.
  4. Staining: Match the Architect's sample.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Inspect door frames and doors before beginning door installation.
  - 1. Verify that frames are properly installed and aligned and are capable of providing trouble free support for doors throughout range of door swing.
- B. Correct unsatisfactory conditions before installing products of this section. Commencement of installation indicates acceptance of conditions.

#### 3.02 INSTALLATION

- A. Hardware Installation: Elsewhere in Division 8.
- B. Install doors in accordance with manufacturer's recommended procedures and requirements of referenced standard.
- C. Prefit Doors: Minimize field fitting to those procedures which are necessary to complete work unfinished during factory prefitting and to provide trouble free operation.
  - 1. Accurately align and fit doors for trouble free operation throughout range of door swing.
- D. Prefitting Clearances:
  - 1. Door edge and head: 1/8 inch.
  - 2. Door edge and jamb: 1/8 inch.
  - 3. Door bottom edge and top surface of threshold: 1/4 inch.
  - 4. Door bottom edge and floor covering surface or finish (where threshold is not indicated): 1/8 inch.
  - 5. Meeting edges at pairs of doors: 1/8 inch total.
- E. Installation Clearances: Install doors so as to maintain prefitting clearances specified.
- F. Factory-Finished Doors: Before installing doors, restore finish at door edges cut during field fitting.

#### 3.03 ADJUSTING

- A. Adjust doors for proper operation; coordinate with hardware adjustment; replace doors that cannot be properly adjusted.
- B. Where door finishes are damaged during installation, restore in a manner that results in the door showing no evidence of the restoration. If refinished door cannot be made to match other doors, remove refinished door and replace with new conforming work at the Contractor's expense.
- C. Protect installed work.

END OF SECTION



## SECTION 08 71 00 - DOOR HARDWARE

### 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. Commercial Mechanical door hardware, accessories and/or cylinders for the following:
    - a. Swinging doors.
    - b. Overhead/Roll-up doors.
- B. Related Sections include the following:
  - 1. Division 08 Section "Hollow Metal Doors and Frames"
  - 2. Division 08 Section "Flush Wood Doors"
  - 3. Division 08 Section "Aluminum-Framed Entrances and Storefronts"
- C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering and scheduling remain requirements of this Section.
  - 1. Permanent cores to be installed by Owner.

#### 1.3 REFERENCE STANDARDS

- A. This Section references the following Codes/Standards:
  - 1. American National Standards Institute (ANSI) (Current Editions)
    - a. ANSI A117.1 – Accessible and Usable Buildings and Facilities
    - b. ANSI A156 (All related Sections)
  - 2. Builders Hardware Manufacturers Association (BHMA) (Current Editions)
    - a. ANSI/BHMA A156.XX (All related Sections)
  - 3. Door and Hardware Institute (DHI)
    - a. DHI/ANSI A115.IG – Installation Guide for Doors and Hardware.
    - b. DHI Sequence and Format for the Hardware Schedule.
    - c. DHI Recommended Locations for Builder's and Architectural Hardware.
  - 4. National Fire Protection Association (NFPA) (Current Editions)

- a. NFPA 80 – Fire Doors and Windows
  - b. NFPA 101 – Life Safety Code
5. North Carolina Building Code - NCBC
- a. 2012 NCBC

#### 1.4 SUBMITTALS

- A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Details of electrified door hardware, indicating the following:
  1. Wiring Diagrams: Power, signal, and control wiring. Include the following:
    - a. System schematic.
    - b. Point-to-point wiring diagram.
    - c. Riser diagram.
    - d. Elevation of each door.
  2. Detail interface between electrified door hardware, fire alarm, access control, security and building control systems or other systems as may apply.
  3. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.
- C. Samples for Verification: For exposed door hardware of each type, in specified finish, full size. Tag with full description for coordination with the door hardware sets. Submit Samples before, or concurrent with, submission of the final door hardware sets.
  1. Samples will be returned to Contractor. Units that are acceptable through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
- D. Product Certificates: For electrified door hardware, signed by product manufacturer.
  1. Certify that door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.
- E. Qualification Data: For Installer and Architectural Hardware Consultant.
- F. Product Test Reports: If requested by the Architect provide reports based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for locks, latches, delayed-egress locks and closers.
- G. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.
- H. Warranty: Special warranty specified in this Section.
- I. Other Action Submittals:
  1. Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures

and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

- a. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
  - b. Content: Include the following information:
    - 1) Identification number, location, hand, fire rating, and material of each door and frame.
    - 2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
    - 3) Complete designations of every item required for each door or opening including name and manufacturer.
    - 4) Fastenings and other pertinent information.
    - 5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - 6) Explanation of abbreviations, symbols, and codes contained in schedule.
    - 7) Mounting locations for door hardware.
    - 8) Door and frame sizes and materials.
    - 9) Description of each electrified door hardware function, if applicable, including location, sequence of operation, and interface with other building control systems.
      - a) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.
    - 10) List of related door devices specified in other Sections for each door and frame.
    - 11) Product Cut Sheets for all material scheduled.
  - c. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.
2. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant (AHC), detailing Owner's final keying instructions for locks as determined at Key Conference. Include schematic keying diagram and index each key set to unique door designations.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.
1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
  2. Installer shall have warehousing facilities in Project's vicinity.
  3. Scheduling Responsibility: Preparation of door hardware and keying schedules.

4. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Architectural Hardware Consultant (AHC) Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant (AHC) and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
  1. Electrified Door Hardware Consultant Qualifications: A qualified Architectural Hardware Consultant (AHC) who is experienced in providing consulting services for electrified door hardware installations.
- C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
  1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
  1. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches or less above the sill.
- E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Keying Conference: If required by the Architect, conduct conference at a location to comply with requirements in Division 01 Section "Project Management and Coordination." Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
  1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
  2. Preliminary key system schematic diagram.
  3. Requirements for key control system.
  4. Address for delivery of keys.
- G. Pre-installation Conference: If required by the Architect, conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to electrified door hardware including, but not limited to, the following:
  1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
  2. Review sequence of operation for each type of electrified door hardware.
  3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  4. Review required testing, inspecting, and certifying procedures.



1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys and permanent cores, if applicable, to Owner by hand delivery, registered mail or overnight package service.

1.7 COORDINATION

- A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, security system and building control system as applicable for this project.
- C. Existing Openings: Where new hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper operation.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including excessive deflection, cracking, or breakage.
    - b. Faulty operation of operators and door hardware.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
  - 2. Warranty Period: 3 years from date of Final Acceptance, except as follows:
    - a. Bored Locksets: 7 years from date of Final Acceptance.
    - b. Mortise Locksets: 10 years from date of Final Acceptance.
    - c. Exit Devices: 5 years from date of Final Acceptance.
    - d. Manual Closers: 10 years from date of Final Acceptance.

## 1.9 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Final Acceptance, provide 6 months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those used in the manufacture and installation of original products.

## PART 2 - PRODUCTS

### 2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.
  - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
  - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:
  - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required provide as specified.
  - 2. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.
- C. In other Part 2 articles where titles below introduce lists of approved Manufacturers, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 HINGES, GENERAL

- A. Quantity: Provide the following, unless otherwise indicated:
  - 1. Two Hinges: For doors with heights up to 60 inches.
  - 2. Three Hinges: For doors with heights 61 to 90 inches.
  - 3. Four Hinges: For doors with heights 91 to 120 inches.
  - 4. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
- B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

- C. Hinge Weight: Unless otherwise indicated, provide the following:
  - 1. Entrance Doors: Heavy weight antifriction-bearing hinges.
  - 2. Doors with Closers: Standard weight antifriction-bearing hinges.
  - 3. Interior Doors: Standard weight hinges. Provide antifriction-bearing as specified in Part 3 "Door Hardware Sets" Article.
  
- D. Hinge Base Metal: Unless otherwise indicated, provide the following:
  - 1. Exterior Hinges: Stainless steel, with stainless-steel pin or brass, with stainless-steel pin body and brass protruding heads as specified in Part 3 "Door Hardware Sets" Article.
  - 2. Interior Hinges: Brass, with stainless-steel pin body and brass protruding heads, Steel, with steel pin or Stainless steel, with stainless-steel pin as specified in Part 3 "Door Hardware Sets" Article.
  - 3. Hinges for Fire-Rated Assemblies: Steel, with steel pin, Stainless steel, with stainless-steel pin as specified in Part 3 "Door Hardware Sets" Article.
  
- E. Hinge Options: Where indicated in door hardware sets or on Drawings:
  - 1. Non-removable Pins (NRP): Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors and outswinging corridor doors with locks.
  - 2. Corners: Square.
  
- F. Electrified Functions for Hinges: Comply with the following:
  - 1. Power Transfer: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle.
  - 2. Monitoring: Concealed electrical monitoring switch.
  - 3. Power Transfer and Monitoring: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle, and with concealed electrical monitoring switch.
  
- G. Fasteners: Comply with the following:
  - 1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
  - 2. Wood Screws: For wood doors and frames.
  - 3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
  - 4. Screws: Phillips flat-head machine screws (drilled and tapped holes) for metal doors and wood screws for wood doors and frames (Pilot holes required for wood doors and/or frames). For NRP hinges finish screw heads to match surface of hinges.

## 2.3 HINGES

- A. Butts and Hinges: BHMA A156.1. Listed under Category A in BHMA's "Certified Product Directory."
- B. Template Hinge Dimensions: BHMA A156.7.
- C. Approved Manufacturers: (Basis of Design)
  - 1. **Stanley Hardware. (STN)**
  - 2. Bommer Industries
  - 3. McKinney Hinge (MH)

## 2.4 CONTINUOUS HINGES

- A. Standard: BHMA A156.26. Listed under Category N in BHMA's "Certified Product Directory."
- B. General: Minimum 0.120-inch thick, hinge leaves with minimum overall width of 4 inches fabricated to full height of door and frame as recommended by the Manufacturer.
  - 1. Fire Pins: Steel pins to hold labeled fire doors in place if required by tested listing.
- C. Continuous, Pin & Barrel Hinges: Hinge with knuckles formed around a pin that extends entire length of hinge.
  - 1. Base Metal for Exterior Hinges: Stainless steel.
  - 2. Base Metal for Interior Hinges: Stainless steel or steel.
  - 3. Base Metal for Hinges for Fire-Rated Assemblies: Stainless steel or steel.
  - 4. Approved Manufacturers:
    - a. **Stanley Hardware. (STN)**
    - b. Bommer Industries
    - c. McKinney Hinge (MH)
- D. Continuous, Geared Hinges: Extruded-aluminum, geared hinge leaves joined by a continuous extruded-aluminum channel cap with concealed, self-lubricating thrust bearings.
  - 1. Approved Manufacturers:
    - a. **Stanley Hardware. (STN)**
    - b. Bommer Industries
    - c. McKinney Hinge (MH)

## 2.5 LOCKS AND LATCHES, GENERAL

- A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and ANSI A117.1.
  - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
- B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- C. Electrified Locking Devices: BHMA A156.25.
  - 1. Provide as specified in Part 3 "Door Hardware Sets" Article.
- D. Lock Trim:
  - 1. Levers: Provide as specified in Part 3 "Door Hardware Sets" Article.
  - 2. Escutcheons (Roses): Provide as specified in Part 3 "Door Hardware Sets" Article.
  - 3. Dummy Trim: Match lock trim and escutcheons.
  - 4. Lockset Designs: Provide as specified in Part 3 "Door Hardware Sets" Article.

- E. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors and as follows:
  - 1. Bored Locks: Minimum 1/2-inch latchbolt throw.
  - 2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
  - 3. Deadbolts: Minimum 1-inch bolt throw.
- F. Backset: 2-3/4 inches, unless otherwise indicated.
- G. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:
  - 1. Strikes for Bored Locks and Latches: BHMA A156.2.
  - 2. Strikes for Mortise Locks and Latches: BHMA A156.13.
  - 3. Strikes for Interconnected Locks and Latches: BHMA A156.12.
  - 4. Strikes for Auxiliary Deadlocks: BHMA A156.5.
  - 5. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
  - 6. Extended Lip Strikes: For locks used on frames requiring the additional length to protect frame and trim.
  - 7. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.

## 2.6 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:
  - a. Mortise Locks: BHMA A156.13.
- B. Mortise Locks: Stamped steel case with steel or brass parts; BHMA A156.13. Listed under Category F in BHMA's "Certified Product Directory."
  - 1. Approved Manufacturers:
    - a. Best Access Systems. (45H Series)
    - b. **Corbin Russwin (LWM Series) Preferred Brand**
    - c. Schlage Lock Co.

## 2.7 DOOR BOLTS

- A. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
  - 1. Dutch-Door Bolts: Minimum 3/4-inch throw.
  - 2. Mortise Flush Bolts: Minimum 3/4-inch throw.
- B. Dustproof Strikes: BHMA A156.16, Grade 1.
- C. Manual Flush Bolts: BHMA A156.16, Grade 1 unless Grade 2 is indicated designed for mortising into door edge.

1. Approved Manufacturers:

- a. **Trimco.**
- b. Burns Manufacturing Co.
- c. Hager Hinge Co.

D. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1 unless Grade 2 is indicated designed for mortising into door edge.

1. Approved Manufacturers:

- a. **Trimco.**
- b. Burns Manufacturing Co.
- c. Hager Hinge Co.

2.8 EXIT DEVICES

A. Exit Devices: BHMA A156.3, Grade 1 unless Grade 2 is indicated. Listed under Category G in BHMA's "Certified Product Directory."

B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and ANSI A117.1.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.

C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

E. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

F. Removable Mullions: BHMA A156.3.

G. Fire-Exit Removable Mullions: Provide removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions shall be used only with exit devices for which they have been tested.

H. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

1. Operation: Rigid or movable as specified in Part 3 "Door Hardware Sets" Article.

I. Outside Trim: Material and finish to match locksets, unless otherwise indicated.

1. Match design for locksets and latchsets, unless otherwise indicated.

- J. Through Bolts: For exit devices and trim on metal doors, non-fire-rated wood doors and fire-rated wood doors as specified in Part 3 "Door Hardware Sets" Article.
- K. Electronic Exit Bars: Non-latching electronic releasing device, activated by an adjustable capacitance sensor, with no moving parts; listed and labeled as panic exit hardware. Fabricate bar from extruded aluminum, and provide door and frame transfer device and 16 feet of cord to route wiring off the door frame.
- L. Approved Manufacturers:
  - 1. **Von Duprin (VND) \_ Preferred Brand**
  - 2. Precision Hardware Co.
  - 3. Sargent Manufacturing.

## 2.9 LOCK CYLINDERS

- A. Standard Lock Cylinders: BHMA A156.5, Grade 1.
- B. High-Security Lock Cylinders: BHMA A156.30, Grade 1.
  - 1. Key Control Level: Category A.
  - 2. Destructive Test Level: Category A.
  - 3. Surreptitious Entry Resistance Level: Category A.
- C. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
  - 1. Number of Pins: Six or Seven pin as required for this project.
  - 2. Mortise Type: Threaded cylinders with rings and cam as required for proper lock operation.
  - 3. Rim Type: Cylinders with back plate, flat type vertical or horizontal tailpiece and raised trim ring.
  - 4. Bored-Lock Type: Cylinders with tailpieces as required for proper lock operation.
    - a. High-Security Grade: BHMA A156.5, Grade 1A, listed and labeled as complying with pick and drill resistant testing requirements in UL 437 (Suffix A).
- D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
  - 1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.
- E. Construction Keying: Comply with the following:
  - 1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
    - a. Replace construction cores with permanent cores as directed by Owner or Architect.
- F. Manufacturer: Same manufacturer as for locks and latches.
- G. Approved Manufacturers:

**1. Corbin Russwin (CR) (Pyramid– Match Existing System) Preferred Brand**

- H. Key Control System Software: BHMA A156.5, Grade 1; multiple-index system for recording and reporting key-holder listings, tracking keys and lock and key history, and printing receipts for transactions. Include instruction manual.

1. Approved Manufacturers:

**a. Corbin Russwin (CR) (Pyramid Series) Preferred Brand**

**2.10 ELECTRIC STRIKES**

- A. Standard: BHMA A156.31, Grade 1.
- B. General: Use fail-secure electric strikes with fire-rated devices.
- C. Approved Manufacturers:
1. HES, Inc. (HES)
  2. Folger Adams.

**2.11 Von Duprin (VND) Preferred Brand OPERATING TRIM**

- A. Standard: BHMA A156.6 and as illustrated on Drawings.
- B. Materials: Fabricate from aluminum, brass, bronze or stainless steel, unless otherwise indicated in Part 3 "Door Hardware Sets" Article.
- C. Approved Manufacturers:
- a. Trimco.
  - b. **Von Duprin (VND) Preferred Brand**
  - c. Hager Hinge Co.

**2.12 CLOSERS**

- A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and ANSI A117.1.
1. Comply with the following maximum opening-force requirements:
- a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
  - b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
  - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
- B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.



- C. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
- D. Surface Closers: BHMA A156.4, Grade 1 unless Grade 2 is indicated. Listed under Category C in BHMA's "Certified Product Directory." Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.
  - 1. Approved Manufacturers:
    - a. Hager (5100 Series)
    - b. **LCN Closers (4040 Series) Preferred Brand**
    - c. Sargent Manufacturing (281 Series)
- E. Coordinators: BHMA A156.3.
  - 1. Approved Manufacturers:
    - a. Trimco.
    - b. **Glynn Johnson - Preferred Brand**
    - c. Hager Hinge Co.

## 2.13 PROTECTIVE TRIM UNITS

- A. Size: 2 inches less than door width on push side and 1 inch less than door width on pull side, by height specified in door hardware sets.
- B. Fasteners: Manufacturer's standard machine or self-tapping screws.
- C. Metal Protective Trim Units: BHMA A156.6; beveled top and 3 sides (B4E); fabricated from material as specified in Part 3 "Door Hardware Sets" Article.
  - 1. Material: 0.050-inch thick.
  - 2. Approved Manufacturers:
    - a. Trimco.
    - b. Burns Manufacturing Co.
    - c. **Hager Hinge Co. – Preferred Brand**

## 2.14 STOPS AND HOLDERS

- A. Stops and Bumpers: BHMA A156.16, Grade 1.
  - 1. Provide floor stops for doors unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.
- B. Mechanical Door Holders: BHMA A156.16, Grade 1.
- C. Combination Floor and Wall Stops and Holders: BHMA A156.8, Grade 1.
- D. Combination Overhead Stops and Holders: BHMA A156.8, Grade 1.

- E. Electromagnetic Door Holders: BHMA A156.15. Listed under Category C in BHMA's "Certified Product Directory."
  - 1. Coordinate with fire detectors and interface with fire alarm system for labeled fire door assemblies.
- F. Silencers for Wood Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum 5/8 by 3/4 inch fabricated for drilled-in application to frame.
- G. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch fabricated for drilled-in application to frame.
- H. Approved Manufacturers:
  - a. Trimco.
  - b. **Glynn Johnson – Preferred Brand**
  - c. Hager Hinge Co.

## 2.15 DOOR GASKETING

- A. Standard: BHMA A156.22. Listed under Category J in BHMA's "Certified Product Directory."
- B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
  - 1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
  - 2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
  - 3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.
- C. Air Leakage: Not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.
- D. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.
  - 1. Provide smoke-labeled gasketing on 20-minute-rated doors and on fire and/or smoke-labeled doors.
- E. Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
  - 1. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches or less above the sill].
- F. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.
- G. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- H. Gasketing Materials: ASTM D 2000 and AAMA 701/702.

- I. Approved Manufacturers:
  - 1. **National Guard Products. (NGP)**
  - 2. Pemko.
  - 3. Reese.

## 2.16 THRESHOLDS

- A. Standard: BHMA A156.21. Listed under Category J in BHMA's "Certified Product Directory."
- B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and ANSI A117.1.
  - 1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
- C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch high.
- D. Approved Manufacturers:
  - 1. **National Guard Products. (NGP)**
  - 2. Pemko.
  - 3. Reese.

## 2.17 MISCELLANEOUS DOOR HARDWARE

- A. Boxed Power Supplies: Modular unit in NEMA ICS 6, Type 4 enclosures; filtered and regulated; voltage rating and type matching requirements of door hardware served; and listed and labeled for use with fire alarm systems.
- B. Auxiliary Hardware: BHMA A156.16, Grade 1.
  - 1. Approved Manufacturers:
    - a. Trimco.
    - b. **Altronix – Preferred Brand**
    - c. Hager Hinge Co.

## 2.18 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
  - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and

BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

- C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
  - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
  - 2. Steel Machine or Wood Screws: For the following fire-rated applications:
    - a. Mortise hinges to doors.
    - b. Strike plates to frames.
    - c. Closers to doors and frames.
  - 3. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:
    - a. Surface hinges to doors.
    - b. Closers to doors and frames.
    - c. Surface-mounted exit devices.
  - 4. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
  - 5. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."

## 2.19 FINISHES

- A. Standard: BHMA A156.18, as indicated in door hardware sets.
- 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 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Steel Doors and Frames: Comply with DHI A115 Series.
  - 1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.
- B. Wood Doors: Comply with DHI A115-W Series. Drill pilot holes of appropriate size for ALL wood door installations.

### 3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated on Drawings and/or as follows unless otherwise indicated or required to comply with governing regulations.
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
  - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
  - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
  - 3. Drill pilot holes of appropriate size for ALL wood door installations.
- C. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- D. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated verify location with Architect.
  - 1. Configuration: Provide the least number of power supplies required to adequately serve doors with electrified door hardware.
- E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
  - 1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
  - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
  - 3. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- B. Occupancy Adjustment: Approximately 6 months after date of Final Acceptance, Installer shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Final Acceptance.

3.6 DOOR HARDWARE SETS

**HARDWARE SET # 01.0 - GEOSCIENCES FIELD EQUIPMENT (2-3970/HMDXHMF)**

DOOR(S): 149,

EACH TO  
 HAVE:

QTY	UNIT	PRODUCT	DESCRIPTION	FINISH	MFG
2	EA	CONTINUOUS HINGE	651HD X LAR	630	STN
2	EA	FLUSH BOLT	3917-12	626	TRM
1	EA	LOCKSET	ML2057 LWM (STOREROOM) (LESS CYLINDER)	626	CR
1	EA	CYLINDER	MORTISE/RIM X LENGTH X CAM/TP X MATCH OWNER'S ACADEMIC PYRAMID KEY SYSTEM	626	CR
1	EA	CLOSER	4041 SERIES (MOUNT PARALLEL ARM - PUSH SIDE) (ACTIVE LEAF)	689	LCN
2	EA	PROTECTION PLT	KO050 10" X 1" LDW B4E/CSK (KICK - PUSH SIDE)	630	TRM
2	EA	FLOOR STOP	1209 (MOUNT AT MAX DR SWING)	630/RBR	TRM

2	EA	SWEEP	601A X LAR	A	NGP
1	EA	SEAL	5020 X LAR (HEAD/JAMBS)	BLK	NGP
1	EA	THRESHOLD	896S X LAR X 1/4-20 SS MSEA	A	NGP

**HARDWARE SET # 02.0 - RESEARCH, PPHYSICS TEACHING LAB (1-3070 & 1-2870/SCWDXHMF) UNEQUAL PAIR**

DOOR(S): 152, 153,

EACH TO  
 HAVE:

QTY	UNIT	PRODUCT	DESCRIPTION	FINISH	MFG
6	EA	HINGE	FBB179 4.5 X 4.5 (NRP AT OUTSWING/LOCKED OPENINGS)	652	STN
2	EA	FLUSH BOLT	3917-12"	630	TRM
1	EA	LOCKSET	ML2055 LWM (CLASSROOM) (LESS CYLINDER)	626	CR
1	EA	CYLINDER	MORTISE/RIM X LENGTH X CAM/TP X MATCH OWNER'S ACADEMIC PYRAMID KEY SYSTEM	626	CR
1	EA	CLOSER	4041 SERIES (ACTIVE LEAF) (MOUNT PARALLEL ARM - PUSH SIDE)	689	LCN
1	EA	OVERHEAD STOP	N4420 SERIES (INACTIVE LEAF) (MOUNT PUSH SIDE)	630	ABH
2	EA	PROTECTION PLT	KO050 10" X 1" LDW B4E/CSK (KICK - PUSH SIDE)	630	TRM
2	EA	SILENCER	1229A (HM FRAME)	GREY	TRM

END OF SECTION 08 7100

SECTION 08 80 00 - GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Clear Tempered Glass.

1.02 REFERENCES

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.
- C. ASTM C1036 - Standard Specification for Flat Glass; 2016.
- D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- E. GANA (GM) - GANA Glazing Manual; 2008.
- F. GANA (SM) - GANA Sealant Manual; 2008.

1.03 SUBMITTALS

- A. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods.

1.05 WARRANTY

- A. Provide a ten year warranty to include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

- A. Refer to Section 01 60 00 - Product Requirements.

2.02 FLAT GLASS MATERIALS

- A. Tempered Safety Glass (08 80 00.TS): Clear; fully tempered with horizontal tempering.
  - 1. Comply with ASTM C1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select) and ASTM C1048.
  - 2. Comply with ANSI Z97.1.

2.03 FIRE RATED GLAZING PRODUCTS

- A. Fire Rated Safety Glass: (08 80 00.FS) Laminated Ceramic Glazing Material.
  - 1. Safety Rated: Laminated, Comply with ANSI Z97.1 and CPSC 16 CFR 1201 (Cat I and II).
  - 2. Fire Rating: 20 minutes, 45 minutes, 60 minutes, 90 minutes, 3 hour with hose stream test.
  - 3. Thickness: 5/16 inch, (8 mm) overall.
  - 4. STC Rating: 35dB.
  - 5. Products:
    - a. FireLite Plus by Nippon Electric Glass Co., distributed by Technical Glass Products.
    - b. Pyran Platinum L; Schott North America, Inc.
    - c. SGG Keralite FR-L by Vetrotech Saint Gobain North America.



PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 INSTALLATION

- A. Install glazing in accordance with GANA (GM) and system manufacturer's instructions.

3.03 CLEANING

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

END OF SECTION

## SECTION 09 05 61 - PREPARATION OF CONCRETE TO RECEIVE ADHESIVELY INSTALLED FLOORING

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

- A. Removal of existing floor coverings.
- B. Testing of concrete floors that will receive adhesively applied floor covering.
- C. Testing of floor slabs for adhesive bond.
- D. Preparation of concrete floor slabs for installation of floor coverings.
- E. Remediation of concrete floor slabs where testing indicates unsatisfactory moisture or pH conditions or unsatisfactory adhesive bond.
  - 1. Contractor shall perform all specified remediation of concrete floor slabs.

## 1.02 PRICE AND PAYMENT PROCEDURES

- A. Moisture and pH testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Include the cost of moisture and pH testing in the base bid.
- C. Include the cost of standard adhesive in the base bid.
- D. Unit Prices: See Section 01 22 00 - Unit Prices.
- E. Unit Price for Standard Flooring Adhesive: State on the bid form the unit price per square foot for using the floor covering manufacturer's standard adhesive.
  - 1. Provide a unit price for each distinct type of floor covering.
- F. Unit Price for Moisture-Resistant Flooring Adhesive: State on the bid form the unit price per square foot for using the moisture-resistant flooring adhesive.
  - 1. Provide a unit price for each distinct type of floor covering.
- G. Unit Price for Moisture-Resistant Sealer-Surfacer: State on the bid form the unit price per square foot for the moisture-resistant sealer-surfacer.
  - 1. Provide a unit price for each distinct type of floor covering.

## 1.03 REFERENCES

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2016a.
- B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete; 1999 (Reapproved 2014).
- C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.
- D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
- E. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2011.

## 1.04 SUBMITTALS

- A. Visual Observation Report: For existing floor coverings to be removed.
- B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
  - 1. Moisture and pH limits and test methods.
  - 2. Manufacturer's required bond/compatibility test procedure.
- C. Testing Agency's Report: Include:
  - 1. Description of areas tested; include floor plans and photographs if helpful.
  - 2. Summary of conditions encountered.

3. Moisture and pH test reports in the format required by referenced test method.
4. Copies of specified test methods.

- D. Adhesive Bond and Compatibility Test Report.
- E. Copy of RFCI (RWP) Recommended Work Practices for Removal of Resilient Floor Coverings.
- F. Product Data: Manufacturer's published data on each product specified in Part 2.
  1. Manufacturer's installation instructions.
- G. Moisture-Resistant Installer Qualifications: Signed by the materials manufacturer.

#### 1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified, and acceptable to the Owner.
  1. Submit evidence of experience consisting of at least 3 test reports of the type required, with the respective project owner's project contact information.
- B. Contractor's Responsibility Relating to Independent Agency Testing:
  1. Provide access for and cooperate with testing agency.
  2. Confirm date of start of testing at least 10 days prior to actual start.
  3. Allow at least 4 business days on site for testing agency activities.
  4. Achieve and maintain specified ambient conditions.
  5. Allow ample time for testing activity and remedial measures, if necessary, in the Construction Project Schedule. Notify Owner and Architect when specified ambient conditions have been achieved, and coordinate dates of testing with the parties involved.
- C. Moisture-resistant sealer-surfacer Installer: Approved by materials manufacturer.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

#### 1.07 FIELD CONDITIONS

- A. In spaces where concrete testing will be performed, maintain ambient temperature at anticipated in-service temperature for not less than 48 hours prior to and during testing.
- B. In spaces where concrete testing will be performed, maintain relative humidity at anticipated in-service humidity level for not less than 48 hours prior to and during testing.

### PART 2 PRODUCTS

#### 2.01 REMEDIATIONS

- A. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
- B. Excessive Moisture Emission or Relative Humidity or excessive pH: If an adhesive that is resistant to the level of moisture and pH present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply Moisture-Resistant Sealer-Surfacer over entire floor area.

#### 2.02 MATERIALS

- A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
  1. Cementitious compound, resistant to moisture, mildew, and alkali, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.

2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
  3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
- B. Moisture-Resistant Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.
- C. Moisture-Resistant Sealer-Surfacer: Multi-coat system comprising epoxy sealer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of pH found, followed by surfacing coat that acts to relieve osmotic vapor pressure and provides a suitable profile for adhesion of floor coverings without further treatment.
1. Mechanically abrade concrete to achieve ICRI Concrete Surface Profile (CSP) of 3 before applying moisture-resistant sealer-surfacer.
  2. Products:
    - a. ARDEX Engineered Cements; [www.ardexamericas.com](http://www.ardexamericas.com).
      - 1) 3-coat system: Ardex MC Rapid, Ardex P 82 Ultra Prime, and either Ardex Feather Finish, Ardex V1200, or Ardex K13 depending on project conditions.
    - b. Koster American Corporation; [www.kosterusa.com](http://www.kosterusa.com).
      - 1) 3-coat system: Koster VAP I 2000, Koster I 09 Primer, Koster SL Premium.
    - c. Sika Corporation; [www.sikafloorusa.com](http://www.sikafloorusa.com).
      - 1) 3-coat system: Sika MB, SikaLevel-02 EZ Primer, and either SikaLevel Skim Coat, SikaLevel-125, or SikaLevel-325.
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Leveler / Resurfacer: Product intended by its manufacturer to restore rough, uneven concrete substrate to a smooth, level surface suitable to receive adhesively applied floor covering.
1. Products:
    - a. ARDEX Engineered Cements : Ardex FeatherFinish; [www.ardexamericas.com](http://www.ardexamericas.com).
      - 1) Over concrete: Mechanically abrade concrete to achieve ICRI Concrete Surface Profile (CSP) of 3 before applying leveler / resurfacer.
    - b. ARDEX Engineered Cements : Ardex K 55 Microtec; [www.ardexamericas.com](http://www.ardexamericas.com).
      - 1) Over concrete: Mechanically abrade concrete to achieve ICRI Concrete Surface Profile (CSP) of 3 before applying leveler / resurfacer.
      - 2) Over Ardex MC series: Ardex P 82 Ultra Prime.
    - c. Koster American Corporation: Koster SL Premium Overlay; [www.kosterusa.com](http://www.kosterusa.com).
      - 1) Over concrete: Mechanically abrade concrete to achieve ICRI Concrete Surface Profile (CSP) of 3 followed by Koster SB Bonding Emulsion.
      - 2) Over Koster VAP I 2000: Koster VAP I 06 Primer.
    - d. Substitutions: See Section 01 60 00 - Product Requirements.

## PART 3 EXECUTION

### 3.01 GENERAL

- A. Perform following operations in the order indicated:
1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
    - a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
    - b. Removal of existing floor covering.
  2. Preliminary cleaning.
  3. Testing.
    - a. Perform both moisture vapor emission and internal relative humidity tests. One type of test alone is not satisfactory.
    - b. Perform the following types of test in close proximity to each other:

- c. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer. Ensure that a portion of the tests are adjacent to exterior walls and to expansion and control joints.
  - d. Internal Relative Humidity Tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer. Ensure that a portion of the tests are adjacent to exterior walls and to expansion and control joints.
  - e. pH tests; at same frequency as other tests.
- 4. Specified moisture remediation, if required.
  - 5. Patching, smoothing, and leveling, as required.
  - 6. Other preparation specified.
  - 7. Adhesive bond test performed by flooring installer.
  - 8. Protection.

### 3.02 EXISTING FLOOR COVERINGS

- A. Remove existing floor coverings, adhesives, and underlayments down to bare concrete.
- B. Comply with Local, State, and Federal regulations and recommendations of RFCI (RWP) Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.
- C. Dispose of removed materials in accordance with Local, State, and Federal regulations and as specified.

### 3.03 PRELIMINARY CLEANING

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

### 3.04 MOISTURE VAPOR EMISSION TESTING

- A. Test new and existing concrete floors for moisture vapor emission.
- B. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- C. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- D. Test in accordance with ASTM F1869 and as follows.
- E. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- F. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.
- G. Report: Report the information required by the test method.

### 3.05 INTERNAL RELATIVE HUMIDITY TESTING

- A. Test new and existing concrete floors for relative humidity.
- B. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- C. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- D. Test in accordance with ASTM F2170 Procedure A and as follows.
- E. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.

F. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

G. Report: Report the information required by the test method.

### 3.06 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Test floors for adhesive bond of floor covering to floor slabs that have been prepared in accordance with floor covering manufacturer's recommendations.

B. In the event that bond does not comply with floor covering manufacturer's requirements, perform surface preparation and remediation as recommended by floor covering manufacturer.

### 3.07 REMEDIATION OF FLOORS TO RECEIVE FLOOR COVERING

A. Comply with requirements and recommendations of product manufacturer.

B. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities as recommended by product manufacturer.

C. Do not fill expansion joints, isolation joints, or other moving joints.

### 3.08 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION



SECTION 09 06 10 - PARTITION SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Partitions faced with gypsum panels, and including facings of:

1.02 DEFINITIONS

- A. Partitions: Every partition dividing two spaces is a noise, air, and dust control partition.

PART 2 PRODUCTS

2.01 GYPSUM PANEL FACINGS

- A. Provide types of gypsum panels in locations listed below.
- B. General use, and where not otherwise indicated:
  - 1. Provide gypsum wallboard.

2.02 PRODUCTS

- A. Provide products specified elsewhere in Division 4 and Division 9.

PART 3 EXECUTION

3.01 GENERAL

- A. Construct partitions in accordance with requirements specified elsewhere in Division 4 and Division 9.
- B. Seal smoke, noise, air, and dust partitions in accordance with requirements specified in Gypsum Board Assemblies section and Joint Sealers section.

3.02 PARTITION LEGEND

- A. On the drawings, partition types are indicated using tags composed generally as follows (see individual descriptions in partition schedule below for specific requirements).
- B. First Position: Fire rating.
  - 1. Zero, 1, 2, 3, or 4 hours.
- C. Second Position: Construction Material. Extend all partitions and materials from floor to overhead solid structure unless otherwise indicated.
  - 1. A Metal studs and gypsum panels from floor to 6" above ceiling.
  - 2. SA Metal studs to structure, gypsum panels from floor to 6" above ceiling.
  - 3. S Metal studs and gypsum panels.
  - 4. U Steel studs and gypsum board from floor to underside of ceiling.
- D. Third Position: Indicates construction features as described under individual descriptions in partition schedule below.
- E. Fourth Position:
  - 1. G Gypsum panels (wallboard, tile backer, veneer base, etc.); type of panel as specified above under "gypsum panel facings".
- F. Final Position, outside of box on drawings:
  - 1. Dimension of stud or masonry measured to outside face. Dimensions of stud are actual. Dimensions of masonry are actual unless indicated otherwise.
  - 2. Where no stud dimension is indicated adjacent to box, provide 3-5/8-inch studs.
  - 3. Where no dimension is indicated adjacent to box for shaftwall framing, provide 4-inch framing.

3.03 PARTITION SCHEDULE

END OF SECTION





SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior metal stud wall framing.
- B. Gypsum wallboard.
- C. Interior gypsum ceilings/soffits.
- D. Joint treatment and accessories.
- E. Level 5 finish under semi-gloss and gloss paint.

1.02 REFERENCES

- A. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2019a.
- C. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2018.
- D. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017.
- F. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.
- G. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2018.
- H. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2019b.
- I. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2018.

1.03 SUBMITTALS

- A. Product Data: Provide manufacturer's product data for systems required. Include installation instructions and data sufficient to show compliance with requirements.
- B. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- C. Design Data:
  - 1. Submit data substantiating gage and spacing of metal framing members to comply with specified loading requirements.
  - 2. Submit data substantiating bracing requirements.
  - 3. Submittal of manufacturer's standard published load tables, marked to show products selected to comply with design requirements and project conditions, will be acceptable. Where manufacturer's standard published load tables are not adequate to demonstrate compliance with design requirements and project conditions, submit design data bearing the seal of a professional engineer licensed to practice in the state in which the project is located.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original and unopened packages, containers, or bundles, with brand names and manufacturer's labels intact and legible.
- B. Store materials in dry location, fully protected from weather and direct exposure to sunlight.
- C. Stack gypsum board products flat and level, properly supported to prevent sagging or damage to ends and edges.

- D. Store corner bead and other metal and plastic accessories to prevent bending, sagging, distortion, or other mechanical damage.

#### 1.05 PROJECT CONDITIONS

- A. Do not store or install products until building is fully enclosed and temperature and humidity controlled.
- B. Temperature: Maintain temperature in areas of installation between 50 and 80 degrees F for at least 48 hours before installation begins and continuously thereafter.
- C. Ventilation: Provide controlled ventilation and dehumidification.
- D. Do not allow excessive variations in humidity or temperature.

### PART 2 PRODUCTS

#### 2.01 SUBSTITUTIONS

- A. Refer to Section 01 60 00 - Product Requirements.

#### 2.02 METAL FRAMING MATERIALS

- A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel of size and properties necessary to comply with ASTM C754, for the spacing indicated.
  - 1. Studs: C-shaped .
    - a. Nominal depths: As indicated in Section 09 06 10 or as otherwise indicated on the drawings.
  - 2. Runners: U-shaped, sized to match studs.
    - a. Nominal depths: As indicated in Section 09 06 10 or as otherwise indicated on the drawings.
  - 3. Ceiling Channels: C-shaped, cold-rolled.
  - 4. Furring:
    - a. Hat-shaped, minimum depth of 7/8 inch, except as otherwise indicated.
  - 5. Thickness: Provide thickness as required for span, loading, deflection, and other required criteria.
    - a. Minimum thickness, all locations, unless otherwise indicated: 0.0188 inch design thickness / 0.0179 inch minimum base metal thickness.
    - b. So-called "EQ" or "equivalent gage" framing with thickness equal to or greater than specified above is acceptable. So-called "EQ" or "equivalent gage" framing with thickness less than specified above is not acceptable.
  - 6. Finish: G40 hot-dip galvanized per ASTM A653/A653M.
    - a. So-called "G40e" equivalent coating is not acceptable.
  - 7. Stud spacing: 16 inches, maximum.
  - 8. Furring spacing: 16 inches on center, maximum.
  - 9. Maximum deflection of wall framing of L/240 at 5 psf.
- B. Establish bracing size and spacing for the following partitions. (See Section 09 06 10 - Partition Schedule):
  - 1. Type A.
  - 2. Type SA.
  - 3. Type U.
  - 4. Type F and Z when furring is installed over spaced supports.
- C. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
- D. Partition Head To Structure Connections:
  - 1. Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and screwed to secondary deflection channel set inside but unattached to top track.

#### 2.03 GYPSUM BOARD MATERIALS

- A. Gypsum Wallboard: ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Thickness: 5/8 inch, all locations. 1/2 inch not acceptable.
2. Edges: Tapered; beveled or rounded.
3. Type X: Fire resistant, UL or Intertek rated.

#### 2.04 ACCESSORIES

- A. Except as otherwise specifically indicated, provide trim and accessories by manufacturer of gypsum board materials, made of galvanized steel or zinc alloy and configured for concealment in joint compound.
  1. Include corner beads, edge trim, and other trim units necessary for project conditions. Provide accessories as required in order to achieve details indicated, whether or not specific accessories are shown on the drawings.
  2. Exposed trim: At locations indicated, provide manufacturer's standard metal units designed to be left exposed or semi-exposed.
- B. Corner Beads: Galvanized steel.
- C. Edge Trim: Bead types as detailed.
- D. Control Joints: At locations indicated, provide manufacturer's standard one-piece control joints of zinc alloy.
- E. Extruded Aluminum Partition Closure:
  1. Preassembled, spring loaded extruded aluminum partition closures to seal gap between partitions and glazing system.
  2. STC Rating: 38
  3. Width: as required to seal gap between wall and glazing system.
  4. Finish: Clear anodized aluminum
- F. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
  1. Joint Compound:
    - a. General Interior Use: Ready-mixed vinyl-based joint compound. All-purpose taping and topping compound: type specifically formulated for embedding tape and accessories, for prefilling, and for finishing drywall.
  2. Joint Tape:
    - a. Gypsum wallboard: Provide manufacturer's standard paper type tape.
- G. Screws: ASTM C1002; self-piercing tapping type, lengths as recommended by gypsum board manufacturer for project conditions.
- H. Furring Fasteners/Connectors: Manufacturer's recommended system for specific application indicated, complying with ASTM C754.
- I. Hanger Wire: ASTM A641/A641M, soft, Class 1 galvanized.
  1. Ceiling hangers: Minimum 8 gage wire.
  2. Furring channel ties: Minimum 18 gage wire.
- J. Blocking: Provide metal blocking for mounting of wall cabinets, shelves, toilet accessories, etc.
  1. Provide 6 inch, 16 gage, steel runner notched to bypass steel studs and secured with two 3/8 inch pan head screws.

#### 2.05 ACOUSTICAL MATERIALS

- A. Acoustical Sealants:
  1. Concealed Locations: ASTM C919. Acrylic emulsion latex or water-based elastomeric sealant. Recommended by manufacturer for use in acoustical sealing applications.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that project conditions and substrates are appropriate for work of this section to commence.

- B. Coordinate installation of anchorage devices for suspended ceilings/soffits, verifying that spacing and rated strength are correct for anticipated load conditions.

### 3.02 FRAMING INSTALLATION

- A. Comply with ASTM C754 and manufacturer's instructions.
- B. Fire-rated assemblies: Comply with requirements of tested assemblies.
- C. Studs:
  - 1. Extend partitions to structure unless otherwise indicated.
  - 2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
  - 3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
  - 4. Slab Deflection: At fire-rated partitions, construct slip-joint head in accordance with UL-witnessed reports and manufacturer's recommendations.
- D. Partition heights:
  - 1. Where not indicated otherwise, extend partitions from floor to underside of solid structure above.
  - 2. Where indicated, extend partitions to underside of suspended ceiling or to just above suspended ceiling, as indicated.
    - a. Brace partial height partitions in accordance with design requirements specified in Part 1 of this Section.
  - 3. Blocking and bracing: Install blocking and bracing as recommended by manufacturer for adequate support of wall-mounted items installed as work of other sections.
- E. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double 20 gage, side-by-side studs at jambs on both sides of opening.
  - 1. At openings in fire rated partitions, comply with requirements of governing authorities for framing.
- F. Standard Wall Furring: Install at concrete and masonry walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
  - 1. Orientation on solid walls: Vertical.
- G. Blocking: Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, shelving, and other fixture mounted on partitions. Screw steel blocking channels to studs.
- H. Suspended Ceilings and Soffits:
  - 1. Secure hangers to structure or to anchorage devices so that full strength of hanger can be achieved.
    - a. Install ceiling channels at spacing indicated or required, but not greater than permitted by ASTM C754.
    - b. Secure furring members to ceiling channels by means of clips or wire ties.
  - 2. Level ceiling system to a tolerance of 1/8 inch in 12 feet, or to a higher tolerance if required by specific project conditions.
  - 3. Level soffits to a tolerance of 1/8 inch in 12 feet, or to a higher tolerance if required by specific project conditions.
  - 4. Reinforce openings and interruptions in horizontal framing system with additional furring channels. Ensure that entire suspension system is laterally braced.

### 3.03 NOISE, AIR, AND DUST CONTROL

- A. General: Every partition dividing two spaces is a noise, air, and dust control partition.
  - 1. Seal noise, air, and dust control partitions in accordance with the requirements listed below.
  - 2. Seal gypsum panels used on the interior face of exterior walls in the same manner.

3. Seal gypsum furring panels used on masonry in the same manner.
- B. Seal perimeter of partition with acoustical sealant, complying with recommendations and details in USG Corporation's "Gypsum Construction Handbook" and ASTM C919. Do not install sealant under metal runners. Install 1/4-inch or larger round bead of sealant to in-place runners and adjacent substrate including those used at partition intersections. Immediately place gypsum panel so as to compress bead, leaving 1/8 inch of perimeter relief (or other dimension where indicated) between gypsum panel and adjacent construction. Locate the sealant bead so that the bead seals between the gypsum wallboard, the runner, and the adjacent floor, wall, structure, or other substrate.
  1. Relief Joints: Install sealant between metal edge trim and adjacent construction. Joint size 1/4 inch unless otherwise indicated.
  2. Install sealant beneath control joints.
  3. Install sealant at metal door frames just before inserting face panel.
  4. Carefully seal around penetrations such as electrical boxes, plumbing, cabinets, ducts, and other openings.

### 3.04 GYPSUM BOARD INSTALLATION

- A. Comply with ASTM C840 and manufacturer's instructions.. Install to minimize butt end joints, especially in highly visible locations.
- B. Fire-rated assemblies: Comply with requirements of tested assemblies.
- C. Apply ceiling boards prior to installation of wallboards. Arrange to minimize butt end joints near center of ceiling area.
- D. Install wallboards in a manner which will minimize butt end joints in center of wall area. Stagger vertical joints on opposite sides of walls.
- E. Butt all joints loosely, with maximum of 1/16 inch between boards.
- F. Size panels to provide perimeter relief and install over sealant as specified under noise control, above. Do not install panels unless and until sealant is properly installed.
- G. Place wrapped edges adjacent to one another; do not place cut edges or butt ends adjacent to wrapped edges.
- H. Support all edges and ends of each board on framing or by solid substrate, except that long edges at right angles to framing members in non-fire-rated construction may be left unsupported.
- I. Single-Layer: Install gypsum board vertically, with ends and edges occurring over firm bearing.
  1. On walls and partitions, plan installation so that the leading edge or end of gypsum board is attached to open end of stud flange first.
- J. Double-Layer Installation: Use gypsum backing board or gypsum wallboard for first layer, placed perpendicular to framing or furring members. Place second layer perpendicular to first layer. Offset joints of second layer from joints of first layer.
  1. In ceiling work, install base layer with long edges perpendicular to framing members, with face layer in opposite direction, and with all joints offset.
  2. In wall work, install base layer with long edges parallel to framing members with face layer in opposite direction, and with all joints offset.
  3. Install face layer by means of screws at least 3/8 inch longer than total thickness of gypsum board layers, spaced as specified for the tested assembly.

### 3.05 INSTALLATION OF TRIM AND ACCESSORIES

- A. Comply with manufacturer's recommendations for installation of trim items. Except for items intended by manufacturer to be left exposed or semi-exposed, install trim units for concealment in joint finishing compound. Wherever possible, fasten metal trim items to substrate with same fasteners used to install gypsum board products.

- B. Control Joints: Where control joints are indicated on the drawings, place control joints as shown on the drawings. Where control joints are not indicated on the drawings, place control joints consistent with lines of building spaces and as follows:
  - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
  - 2. Install one-piece control joints at required locations. Do not remove tape until finishing operations are complete.
- C. Corner Beads: Install at external corners, unless details clearly indicate its omission at specific locations. Use longest practical lengths.
- D. Isolation Joints: Where gypsum board construction abuts cabinetry, windows, structural components, and other dissimilar materials, provide isolation by stopping board a minimum of 1/4 inch from structure, for finishing by means of exposed or semi-exposed trim.

### 3.06 JOINT TREATMENT

- A. Finish gypsum board in scheduled areas in accordance with levels defined in ASTM C840.
- B. Do not mix joint compounds except as specifically recommended by manufacturer.
- C. Penetrations in Wallboard: Fill cutouts and openings around fixtures and penetrations with joint compound.

### 3.07 CLEANING

- A. Promptly remove any residual gypsum drywall materials from adjacent or adjoining surfaces, leaving spaces ready for subsequent finishing operations and decorating.

### 3.08 FINISH LEVEL SCHEDULE

- A. Level 1: Above finished ceilings concealed from view; from 8 inches (203 mm) above suspended ceilings to top of partition.
  - 1. Embed tape in joint compound at all joints and interior angles; provide accessories only as detailed.
  - 2. Provide surfaces free of excess joint compound; tool marks and ridges are acceptable.
- B. Level 2: Walls scheduled to receive the following:
  - 1. Utility areas; areas behind cabinetry.
  - 2. Application:
    - a. Embed tape in joint compound at all joints and interior angles.
    - b. Provide one separate coat of compound at all joints, angles, fastener heads, and accessories.
    - c. Provide surfaces free of excess joint compound; tool marks and ridges are acceptable.
- C. Level 4: Surfaces scheduled to receive the following:
  - 1. Flat or eggshell paint finish specified in Section 09 91 00 - Paints and Coatings.
  - 2. All surfaces not otherwise indicated.
  - 3. Application:
    - a. Embed tape in joint compound at all joints and interior angles.
    - b. Provide three separate coats of compound at all joints, angles, fastener heads, and accessories.
    - c. Provide smooth surfaces free of tool marks and ridges.
- D. Level 5: Walls and/or ceilings scheduled to receive the following:
  - 1. Semi-gloss or gloss paint finish specified in Section 09 91 00 - Paints and Coatings.
  - 2. Application:
    - a. Embed tape in joint compound at all joints and interior angles.
    - b. Provide three separate coats of compound at all joints, angles, fastener heads, and accessories.
    - c. Apply a thin skim coat of joint compound or a special-purpose coating to the entire gypsum board surface.

- d. Provide smooth surfaces free of tool marks and ridges.

END OF SECTION



## SECTION 09 24 23 - CEMENT PLASTER CEILINGS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Ceiling framing and furring for metal lath.
- B. Metal lath on ceilings to receive Portland cement plaster.
- C. Portland cement plaster for installation over metal lath.

#### 1.02 REFERENCES

- A. ASTM C 150 - Standard Specification for Portland Cement; 2000.
- B. ASTM C 206 - Standard Specification for Finishing Hydrated Lime; 1984 (Reapproved 1997).
- C. ASTM A 641 - Standard Specification for Zinc-Coated (Galvanized ) Carbon Steel Wire.
- D. ASTM C 847 - Standard Specification for Metal Lath; 1995 (reapproved 2000).
- E. ASTM C 926 - Standard Specification for Application of Portland Cement-Based Plaster; 1998a.
- F. ASTM C 979 - Standard Specification for Pigments for Integrally Colored Concrete; 1982 (Reapproved 1993).
- G. ASTM C 1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster; 1999.
- H. ASTM C 1116 - Standard Specification for Fiber-reinforced Concrete and Shotcrete; 1997.
- I. PCA EB049M - Portland Cement Plaster (Stucco) Manual; Portland Cement Association; 1996.

#### 1.03 SUBMITTALS

- A. Product Data:
  - 1. Provide data on plaster materials, characteristics and limitations of products specified.
  - 2. Provide data on furring and lathing components, structural characteristics, material limitations, and finish.
- B. Shop Drawings: Submit spacings of furring, lathing, and fastening components based on 15 psf uniform load and ASTM C 1063.
  - 1. Hangers.
  - 2. Main runners.
  - 3. Cross furring.
  - 4. Show fastenings.
- C. Sample Panels: Prepare preliminary sample panels to achieve finish color and texture required to match existing and to identify mix proportions.

#### 1.04 QUALITY ASSURANCE

- A. Maintain one copy of each installation standard referenced in PART 3 on site throughout the duration of lathing and plastering work.
- B. Perform Work in accordance with ASTM C 926, ASTM C 1063, and the recommendations of the PCA Portland Cement (Stucco) Manual.
- C. The application shall be carried out in a first class workman-like manner by mechanics experienced in the application of this material. Application shall be performed under experienced supervision and in strict accordance with the contract details and specifications. Work shall be of the highest quality, in accordance with the best trade practices, performed by skilled workmen and accomplished to the satisfaction of the Architect.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver manufactured materials in original unopened packages with manufacturer's label intact.
- B. Cement and Lime:

1. Store units raised above ground on pallets or similar flooring to prevent moisture pick-up.
2. Store units under cover to prevent moisture pick-up from rain or snow.
3. Do not tarp or wrap units so as to trap moisture or to permit condensation to form.
4. Allow air to circulate freely around units.
5. Do not use bags that have been broken or exposed to moisture.

C. Sand:

1. Maintain sand at a constant moisture content.
2. Cover pile when not in use.
3. Arrange pile for free drainage.
4. Do not use the bottom portion of the pile (wet or in contact with earth) in mortar.
5. At Contractor's option use bagged, kiln-dried sand.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply plaster when substrate or ambient air temperature is under 50 degrees F or over 80 degrees F.
- B. Maintain ambient temperature between 50 and 80 degrees F during installation of plaster and 7 days after application of plaster.
- C. If the project schedule does not allow for these conditions to be met without the use of temporary enclosures and heating or cooling, provide temporary enclosures and heating or cooling.
- D. Apply plaster to shaded surfaces, only. Do not apply plaster exposed to direct sunlight. Maintain sunshades in place for 7 days after application.
- E. Provide moist curing, suitable coverings, and wind breaks as necessary for a period of 7 days to prevent premature drying, shrinking, or cracking of freshly applied plaster.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

- A. Refer to Section 01600 - Product Requirements.

2.02 CEILING FRAMING MATERIALS

- A. Furring Channels: Match existing.
- B. Main Ceiling Channels: Match existing.

2.03 LATH

- A. Ribbed Metal Lath: ASTM C 847; 3/8 inch thick.
  1. Weight: 3.4 lb/sq yd.
  2. Backed with treated paper.
  3. Galvanized.

2.04 METAL ACCESSORIES

- A. Ceiling Casing Beads and Corner Beads: Formed zinc, depth governed by plaster thickness, maximum possible lengths, expanded metal flanges, with square edges.
- B. Control Joints: Formed zinc, accordion profile, 2 inch expanded metal flanges each side.
- C. Expansion Joints: Formed zinc, 2-piece sliding profile, 2 inch expanded metal flanges each side.
- D. Vented Expansion Reveals: Formed zinc, 2-piece sliding expansion type, with solid edges, flat or angled to suit project conditions for fastening to adjacent wall or other surfaces.
- E. Tie Wire for Ceilings: ASTM A 641; Annealed, galvanized (Class I) steel, 18 gage.
- F. Manufacturers:
  1. Alabama Metal Industries Corporation (Amico); [www.amico-lath.com](http://www.amico-lath.com).
  2. Stockton Products; [www.stocktonproducts.com](http://www.stocktonproducts.com).

3. Substitutions: Refer to Section 01 60 00 - Product Requirements.

G. Products: Provide as required to match existing profiles.

## 2.05 PLASTER MATERIALS

A. Portland Cement: ASTM C 150, Type I.

1. For exposed to view finish coat: White color.
2. For scratch and brown coats: Grey color is acceptable.

B. Lime: ASTM C 206, Type S.

C. Aggregate: In accordance with ASTM C 926.

1. For exposed to view finish coat: White color.
2. For scratch and brown coats: Light tan/buff/gray colors are acceptable.

D. Water: Clean, fresh, potable and free of mineral or organic matter which can affect plaster.

E. Color Pigment for exposed to view finish coat: ASTM C 979; color as selected by the Architect.

F. Brown Coat Reinforcement: Synthetic fibers, ASTM C 1116 Type III; fibrillated polypropylene; chopped to 1/2 inch nominal length; alkali resistant; manufactured specifically for Portland cement plaster reinforcement.

## 2.06 PLASTER MIXES

A. Proportioning:

1. Base Coat:
  - a. One part Portland cement.
  - b. 5/8 part hydrated lime.
  - c. Minimum 2-1/2 and maximum 4 parts aggregate, per sum of cementitious materials.
  - d. Second Coat: Same as first coat, except minimum 4 parts and maximum 4-1/2 parts aggregate, and synthetic fibers proportioned in accordance with fiber manufacturer's recommendation.
2. Finish Coat:
  - a. One part white Portland cement.
  - b. 1-1/4 parts lime.
  - c. 3 parts white sand, per sum of cementitious materials.
  - d. Pigment as required.

B. Batching:

1. Use positive volumetric means of measuring ingredients.
2. Shovel-full method of measuring sand will not be permitted.
3. Measure sand in a damp, loose condition.
4. Use identical proportions for successive batches.
5. Add color pigments to finish coat in accordance with manufacturer's instructions.
6. Use mechanical mixers to batch and mix single batches only. No double or partial patches.

C. Mixing:

1. Mix only as much plaster as can be used prior to initial set.
2. Protect mixtures from freezing, frost, contamination, and excessive evaporation.
3. Retempering of base coat plaster is permitted one time only. Do not retemper mixes after initial set has occurred.
4. Do not retemper finish coat plaster mixes.

D. Mixing Order: (Add fibers and pigments in accordance with manufacturer's instructions).

1. Water: 75% of total.
2. Sand: Half.
3. Lime: All.
4. Mix: 2 minutes.
5. Portland Cement: All.

6. Sand: Balance.
7. Water: To a workable consistency.
8. Mix: 5 full minutes.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify the suitability of existing conditions before starting work.
- B. Mechanical and Electrical: Verify services within walls are complete, tested, and approved.

#### 3.02 CEILING AND SOFFIT FRAMING

- A. Install lath and furring for plaster work in accordance with ASTM C 1063.
- B. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.
- C. Install furring independent of walls, columns, and above-ceiling work.
- D. Place furring channels perpendicular to main framing. Space furring channels not more than 24 inches on center and not more than 2 inches from perimeter walls.
- E. Where 2-piece expansion joint accessories occur, provide independent support for each half of the accessory to allow movement.
- F. Wire-tie furring to main framing using saddle tie configuration.
- G. Lap splices securely.
- H. Reinforce openings in suspension system which interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.

#### 3.03 CONTROL AND EXPANSION JOINTS

- A. Locate joints as indicated on drawings.
- B. Install control and expansion joints.

#### 3.04 LATH INSTALLATION ON CEILINGS AND SOFFITS:

- A. Refer to architectural drawings for joint locations and accessory type.
- B. Casing Bead and Two-Piece Expansion Joint Installation:
  1. Install casing beads at stucco terminations, openings, and other through penetrations.
  2. Install two piece expansion joints at building expansion joints, where the stucco is to be installed over dissimilar construction or substrates, and at ceiling/soffit perimeters.
- C. Apply metal lath taut, with long dimension perpendicular to supports.
- D. Lap ends 1 inch. No lap shall exceed 2 inches. Lace end laps with tie wire where they occur between supports.
- E. Lap sides of diamond mesh lath at least 1-1/2 inches and not more than 2 inches. Tie laps to each support, and at 9 inches maximum on center between supports.
- F. Nest outside ribs of rib lath together.
- G. Attach metal lath to metal supports using tie wire at maximum 7 inches on center.
- H. Ensure that lath is discontinuous across expansion joints and that each side of the lath is independently supported.
- I. When lath is installed at openings in the plaster surface (access panels, lighting, mechanical openings) as well as re-entrant corners: The corner of the opening shall be cut out of a single sheet of lath so that no lath joints intersect the corner of the opening vertically or horizontally. The lath shall extend past the corner of the opening a minimum of 4 inches horizontally and vertically and to the next framing member. Provide supplementary framing to support edges of lath behind fixtures, hardware, and accessories shown to be attached to plaster construction. Place additional strip mesh diagonally at corners of lathed openings. Secure rigidly in place.

- J. One Piece Expansion/Control Joint Installation (installed after lath installation):
1. Cut lath in a straight line with shears at expansion/control joint location. Do not cut into or damage moisture barrier. Install one piece expansion/control joints over lath at through wall penetrations, for example, above and below doors or windows (unless another type of expansion joint is already provided at these locations). Install one piece expansion/control joints over lath every 144 ft<sup>2</sup> (13 m<sup>2</sup>). Wire tie one piece expansion/control joints to cut lath at no more than 7 inches (178 mm) on center. Make certain lath is discontinuous beneath joints. Do not exceed length to width ratio of 2-1/2 to 1 in expansion/control joint layout and do not exceed more than 18 feet (5.5 m) in any direction without an expansion/control joint.

### 3.05 PREPARATION FOR PLASTERING

- A. Clean all materials deleterious to plaster bond from metal lath and framing. Clean surfaces using acid solutions, solvents, or detergents. Wash surfaces with clean water.
- B. Protect adjacent surfaces including architectural metal framing system from splatter from plastering operations. Promptly remove inadvertent splatters.
- C. Dampening of Base Coats: Prepare a Saturated, Surface-Dry (SSD) substrate to achieve proper suction and bond:
1. Apply a fine spray of clean, potable water to the surface to fully wet the surface.
  2. Allow the substrate to take up the water.
  3. When surface sheen disappears, repeat steps 1 and 2, above, until the substrate is uniformly saturated and water uptake is significantly slowed.
  4. Allow the surface wet sheen to disappear (surface dry) before applying plaster.
  5. Recently applied plaster may require, but 1 or 2 passes to achieve SSD condition.
  6. Dried plaster and solid bases will require multiple passes over a period of up to one hour.

### 3.06 PLASTERING

- A. Observe the environmental requirements specified in Part 1.
- B. Thickness Over Metal Lath - Horizontal Work:
1. First Coat: Nominal 1/4 inch thick.
  2. Second Coat: Nominal 1/4 inch thick.
  3. Finish Coat: Nominal 1/8 inch thick.
- C. Application:
1. Apply second coat as soon as first coat is rigid enough to support the application pressures of the second coat without cracking.
  2. If the second coat is not applied on the same day as the first, moist cure the first coat until the second is applied, and dampen the first coat immediately before applying the second coat.
  3. Moist cure the second coat by applying water as often as necessary, but not less than twice per day, for 2-1/2 days.
  4. Continue protection of the plaster for 5 additional days before applying finish coat.
  5. Dampen the second coat immediately before applying the finish coat.
  6. Finish Texture: Float to a consistent and smooth sand finish.

### 3.07 ERECTION TOLERANCES

- A. Maximum Variation of Completed Work from True Flatness: 1/16 inch measured beneath a straightedge applied at any location across any panel.
- B. Corners: Straight and true when viewed from 10 feet or greater.
- C. Surface Appearance:
1. When plaster is adjacent to walking surfaces; no visible defects will be acceptable when viewed from 2 feet.
  2. Elsewhere: No visible defects will be acceptable when viewed from 10 feet or greater.

D. Defects other than appearance: Not limited by viewing distance.  
END OF SECTION



## SECTION 09 51 00 - ACOUSTICAL CEILINGS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.
- C. Accessories.

#### 1.02 REFERENCES

- A. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
- B. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2019.

#### 1.03 SUBMITTALS

- A. Product Data: Provide data on suspension system components and acoustical units.
- B. Samples: Submit three samples, minimum 6 inches by 6 inches, illustrating material and finish of acoustical units.
- C. Samples: Submit three samples each, 9 inches long, of suspension system main runner and perimeter molding.
- D. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.

#### 1.04 PROJECT CONDITIONS

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

#### 1.05 EXTRA MATERIALS

- A. Provide 3 percent of total acoustical unit area of each type of acoustical unit for Owner's use in maintenance of project.

### PART 2 PRODUCTS

#### 2.01 ACOUSTICAL UNITS

- A. Manufacturers; General:
  - 1. Armstrong World Industries, Inc: [www.armstrong.com](http://www.armstrong.com).
  - 2. CertainTeed: [www.certainteed.com](http://www.certainteed.com).
  - 3. USG: [www.usg.com](http://www.usg.com).
- B. Acoustical Units (AC7):
  - 1. Acoustical Panel: Fabric-faced glass fiber, ASTM E1264, Type XII, Class A, with the following characteristics:
    - a. Size: 24 by 24 inches.
    - b. Thickness: 1 inch.
    - c. Light Reflectance: Not less than 0.88.
    - d. Noise Reduction Coefficient (NRC): Not less than 0.95.
  - 2. Products:
    - a. Armstrong:
      - 1) Acoustical Panel: Optima Open Plan Tegular 3251, tegular edge.
      - 2) Suspension System: Suprafine XL 9/16 Heavy Duty.
    - b. CertainTeed:
      - 1) Acoustical Panel: Symphony f 1342F-OVT-1, reveal edge.



- 2) Suspension System: Elite Narrow Stab System 9/16 Heavy Duty.
- c. USG:
  - 1) Acoustical Panel: Halcyon Climaplus 98225, fine line edge.
  - 2) Suspension System: Centricitee 9/16 Heavy Duty.

## 2.02 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Perimeter Moldings: Same material and finish as grid.
  - 1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
- C. Touch-up Paint: Type and color to match acoustical and grid units.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

### 3.02 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:240.
- C. Locate system on room axis according to reflected plan.
- D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners in excess of 2 degrees.
- J. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
  - 1. Use longest practical lengths.
  - 2. Miter corners.

### 3.03 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Lay directional patterned units with pattern parallel to shortest room axis.
- D. Fit border trim neatly against abutting surfaces.
- E. Install units after above-ceiling work is complete.
- F. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- G. Cutting Acoustical Units:

1. Cut to fit irregular grid and perimeter edge trim.
2. Make field cut edges of same profile as factory edges.
3. Double cut and field paint exposed reveal edges with manufacturer's recommended paint.

H. Where round obstructions occur, provide preformed closures to match perimeter molding.

#### 3.04 ERECTION TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

END OF SECTION



SECTION 09 60 10 - FLOORING TRANSITIONS

PART 1 GENERAL

1.01 SUBMITTALS

- A. Product Data.
- B. Verification Samples: Submit two samples, 6 by 6 inch in size illustrating color and pattern for each product specified.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

- A. Refer to Section 01 60 00 - Product Requirements.

	CARPET	TERRAZZO	RESILIENT FLOORING	WOOD	TILE - AT DOOR	TILE - FIELD	RESINOUS FLOORING	EXPOSED CONCRETE
CARPET	N							
TERRAZZO	A	M						
RESILIENT	F	B	H					
WOOD	K	C	K	N				
TILE - AT DOOR	L	L	L	L	L			
TILE - FIELD	A	C	B	D	N	N		
RESINOUS FLOORING	A	C	C	J	L	B	M	
EXPOSED CONCRETE	G	E	G	J	L	E	C	N

\* NOTE: FLOORING KEYED INTO SLAB.

DESCRIPTION

- A Metal Schluter Reno-TK, Size appropriate for material thicknesses.
- B Metal Schluter-Reno-U, Size appropriate for material thicknesses.
- C Metal Schluter-SCHIENE, Size appropriate for material thicknesses.
- D Metal Schluter-RENO-T, Size appropriate for material thicknesses.
- E Metal Schluter-RENO-RAMP, Size appropriate for material thicknesses.
- F Resilient Johnsonite CTA-XX-H, 1/8" to 1/4"
- G Resilient Johnsonite CTA-XX-J, 0" to 1/4"
- H Resilient Johnsonite CTA-XX-X, 0.80" to 1/8"
- J Resilient Johnsonite CTA-XX-D, 0" to 1/2"
- K Resilient Johnsonite CD-XX-B, 1/8" to 1/2"
- L Marble Threshold.
- M Divider Strip.
- N No Transition Required.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Coordinate and install transitions between each type of flooring in accordance with the table above and the respective flooring specifications.

END OF SECTION

## SECTION 09 65 00 - RESILIENT FLOORING

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Resilient tile flooring.
  - 1. Rubber tile.
- B. Resilient base.
- C. Installation accessories.

#### 1.02 REFERENCES

- A. ASTM F1344 - Standard Specification for Rubber Floor Tile; 2015.
- B. ASTM F1861 - Standard Specification for Resilient Wall Base; 2016.

#### 1.03 SUBMITTALS

- A. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- B. Test Reports: See requirements specified in Section 09 0561 - Preparation for Adhesively Installed Flooring.
- C. Verification Samples: Submit two samples, 6 by 6 inch in size illustrating color and pattern for each product specified.

#### 1.04 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

#### 1.05 EXTRA MATERIALS

- A. Provide 5 percent of installed resilient product of each type and color specified.

### PART 2 PRODUCTS

#### 2.01 SUBSTITUTIONS

- A. Refer to Section 01 60 00 - Product Requirements.

#### 2.02 MATERIALS - TILE FLOORING

- A. Rubber Tile: ASTM F1344, Class I; homogeneous rubber tile with color and pattern throughout thickness.
  - 1. Total Thickness: 0.125 inch.
  - 2. Products:
    - a. Johnsonite; Rubber Floor Tile: [www.johnsonite.com](http://www.johnsonite.com).
      - 1) Size: - as called out on the finish schedule.
      - 2) Color: as called out on the finish schedule.
      - 3) Style: Smooth.
    - b. Roppe; Rubber Floor Tile: [www.roppe.com](http://www.roppe.com).
      - 1) Size: - as called out on the finish schedule.
      - 2) Color: as called out on the finish schedule.
      - 3) Style: Smooth.

#### 2.03 MATERIALS - BASE

- A. Resilient Base: ASTM F1861, Type TP thermoplastic rubber.

1. Height: new construction; 4 inches. Where resilient base is being replaced in the same room as existing resilient base that is not being replaced provide base six inches tall. Field verify height prior to submitting product information.
2. Thickness: 0.125 inch thick.
3. Finish: Matte.
4. Style: Cove.
5. Length: Roll, 100-120 feet.
6. Products:
  - a. BurkeMercer Flooring; Rubbermyte: [www.burkemercer.com](http://www.burkemercer.com).
  - b. Flexco; Base 2000: [www.flexcofloors.com](http://www.flexcofloors.com).
  - c. Johnsonite, Inc; Traditional Rubber Wall DC: [www.johnsonite.com](http://www.johnsonite.com).
  - d. Roppe Corp; 700 Series Wall Base: [www.roppe.com](http://www.roppe.com).
7. New Construction Color: Basis of Design
  - a. Johnsonite Color: Charcoal.
8. Existing Color: field verify base color that will be adjacent to existing base

#### 2.04 ACCESSORIES

- A. Subfloor Filler: Portland cement-based premix latex; type recommended by flooring manufacturers.
- B. Primers and Adhesives: Type recommended by flooring manufacturers.
  1. Where high moisture or pH conditions exist, see additional requirements specified in Section 09 05 61 - Preparation for Adhesively Installed Flooring.
- C. Sealer and Wax/Finish Products: Types recommended by flooring manufacturer.
- D. Transitions:
  1. Products: Refer to Section 09 60 10 Flooring Transitions.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that surfaces are smooth and flat within the tolerances specified for that type of work, are free of substances which would impair bonding of adhesive materials, and are ready to receive resilient product.
- B. Verify that concrete subfloor surfaces are ready for resilient flooring installation by testing for moisture and alkalinity as specified in Section 09 05 61 - Preparation for Adhesively installed Flooring. If test results are not within limits recommended by flooring manufacturer, follow procedures specified in Section 09 05 61.

#### 3.02 PREPARATION

- A. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
- B. Clean substrate.

#### 3.03 INSTALLATION - TILE FLOORING

- A. Install in accordance with manufacturer's instructions.
- B. Mix tile from different containers to ensure shade variations are consistent when tile is placed.
- C. Spread only enough adhesive to permit installation of materials before initial set.
- D. Set flooring in place, press with heavy roller to attain full adhesion.
- E. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern, unless indicated otherwise in drawings.
- F. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

- G. Install transition strips at unprotected or exposed edges, where flooring terminates, and where indicated.
- H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

#### 3.04 INSTALLATION - BASE

- A. Cut vertical joints and fit tightly. Maintain minimum dimension of 18 inches between joints.
- B. At external corners, v-cut back of base strip to two-thirds of its thickness and fold.
- C. Miter cut internal corners.
- D. Install base on solid backing. Bond tightly to surfaces.
- E. Scribe and fit to door frames and other interruptions.

#### 3.05 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean, seal, and wax resilient flooring products in accordance with manufacturer's instructions.

#### 3.06 PROTECTION OF FINISHED WORK

- A. Prohibit traffic on resilient flooring for 48 hours after installation.
- B. Protect installed products until completion of project.

END OF SECTION





SECTION 09 67 00 - FLUID-APPLIED FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fluid-applied flooring and base.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
- C. Samples: Submit two samples, 12 by 12 inch in size illustrating color and finish for each floor material for each color specified.
- D. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Applicator's Qualification Statement.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section.
  - 1. Minimum 5 years of documented experience.
  - 2. Approved by manufacturer.

1.04 MOCK-UP

- A. Construct in-place mock-up(s) of fluid applied flooring to serve as basis for evaluation of texture and workmanship. Approved mock-up can remain in-place once approved. Rejected mock-ups shall be removed at contractors expense.
  - 1. Number of Mock-Ups to be Prepared: One.
  - 2. Use same materials and methods for use in the work.
  - 3. Locate where directed.
  - 4. Minimum Size: 48 inches by 48 inches.
- B. Obtain approval of mock-up by Architect before proceeding with work.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store resin materials in a dry, secure area.
- B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.06 FIELD CONDITIONS

- A. Maintain minimum temperature in storage area of 55 degrees F.
- B. Store materials in area of installation for minimum period of 24 hours prior to installation.
- C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fluid-Applied Flooring:

## 2.02 FLUID-APPLIED FLOORING SYSTEMS

- A. Fluid-Applied Flooring: intermediate coat(s), and/or top coat as recommended by the manufacturer, no flake, no aggregate.
  - 1. Total System Thickness: 8-15mil mils, nominal, when dry.
  - 2. Texture: Slip resistant.
  - 3. Sheen: Gloss.
  - 4. Color: As selected by Architect from the manufacturer's standard color line.
  - 5. Basis of Design Product: Tnemec; Series 280; Top Coat 8-10mil: [www.tnemec.com](http://www.tnemec.com).
  - 6. Products:
    - a. PPG Paints Megaseal Fluid Applied Flooring; Megaseal SL Self Leveling Epoxy and Megaseal HPU: [www.ppgpmc.com](http://www.ppgpmc.com).
    - b. Sherwin-Williams Company: General Polymers Brand; HardTop System, intermediate and top coat: [www.sherwinwilliams.com](http://www.sherwinwilliams.com): [www.generalpolymers.com](http://www.generalpolymers.com).
    - c. Sika Corporation; Sika 264 10-12 mil Intermediate Coat with Sika 316 3 mil Top Coat: [www.sikafloorusa.com/#sle](http://www.sikafloorusa.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.

## 2.03 ACCESSORIES

- A. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.
- B. Primer: Type recommended by fluid-applied flooring manufacturer.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive flooring.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.
- D. Verify that required floor-mounted utilities are in correct location.

### 3.02 PREPARATION

- A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler recommended by manufacturer for type of floor being covered.
- B. Screen the floor to achieve a slightly scarified surface
- C. Vacuum clean substrate.
- D. Apply primer to surfaces required by flooring manufacturer.

### 3.03 INSTALLATION - FLOORING

- A. Apply, squeegee and backroll, brush small areas only, in accordance with manufacturer's instructions.
- B. Apply each coat to minimum thickness required by manufacturer.
- C. Finish to smooth level surface.
- D. Cove at vertical surfaces.

### 3.04 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Barricade area to protect flooring until fully cured.

END OF SECTION

SECTION 09 68 00 - CARPET

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet tile, fully adhered.
- B. Removal of existing carpet tile.
- C. Accessories.

1.02 REFERENCES

- A. CRI (GLA) - Green Label Testing Program - Approved Adhesive Products; [www.carpet-rug.org](http://www.carpet-rug.org); current edition.

1.03 SUBMITTALS

- A. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- B. Manufacturer's Installation Instructions: Indicate special procedures.
- C. Samples: Submit two samples 24 x 24 inch in size illustrating color and pattern for each carpet and cushion material specified.
- D. Shop Drawings: Indicate seaming plan, method of joining seams, direction of carpet pile and pattern, location of edge moldings and edge bindings, and layout of flat wire system.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet with minimum three years experience.

1.05 MAINTENANCE

- A. Extra Materials
  - 1. Provide 10% of carpet tiles of each color and pattern selected.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

- A. Refer to Section 01 60 00 - Product Requirements.

2.02 MANUFACTURERS

- A. Carpet:
  - 1. Tarket, Inc: Powerbond Hybrid Resilient|Modular, Marled Tweed 11072, Cloud Tweed 27307; [www.commercial.tarkett.com](http://www.commercial.tarkett.com). Architect will select final color from standard palette.
  - 2. Basis of Design to match existing: Bentley Mills: Discord, Unruly 402249; [www.bentleymills.com](http://www.bentleymills.com)
  - 3. Interface, Inc: Equilibrium, Equality 4722; [www.interfaceinc.com](http://www.interfaceinc.com). Architect will select final color from standard palette.

2.03 CARPET TILE

- A. Carpet Tile Type Patterned Loop: Tufted, manufactured in one color dye lot.
  - 1. Product: Basis of Design: Bentley Discord 4DCT5
  - 2. Tile Size: 18 x 36 inch, nominal.
  - 3. Thickness: 1/4 inch.
  - 4. Dye Method: Solution Dyed
  - 5. Color: Unruly 402249.
  - 6. Pattern: Vertical Ashlar.

7. Backing: Afirma II Hardback
8. Total Weight: 62 oz/sq yd.

#### 2.04 ACCESSORIES

- A. Adhesives: Type recommended by flooring manufacturers.
  1. Where high moisture or pH conditions exist, see additional requirements specified in Section 09 0561 - Preparation of Concrete to Receive Adhesively Installed Flooring.
- B. Transitions:
  1. Product: Refer to Section 09 60 10 - Flooring Transitions.
  2. Color: Select from manufacturer's standard colors.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that concrete subfloor surfaces are ready for flooring installation by testing for moisture and alkalinity as specified in Section 09 0561 - Preparation of Concrete to Receive Adhesively Installed Flooring. If test results are not within limits recommended by flooring manufacturer, follow procedures specified in Section 09 0561.

#### 3.02 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
- B. Clean substrate.

#### 3.03 CARPET TILE INSTALLATION

- A. Install carpet tile in accordance with manufacturer's instructions and CRI 104.
- B. Blend carpet from different cartons to ensure minimal variation in color match.
- C. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- D. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
- E. Locate change of color or pattern between rooms under door centerline.
- F. Fully adhere carpet tile to substrate.
- G. Trim carpet tile neatly at walls and around interruptions.
- H. Complete installation of edge strips, concealing exposed edges.

#### 3.04 CLEANING

- A. Remove excess adhesive from floor and wall surfaces without damage.
- B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 91 00 - PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Paints and Coatings on Exterior Substrates.
  - 1. Ferrous metals.
  - 2. Galvanized metals.
- D. Paints and Coatings on Interior Substrates.
  - 1. Concrete walls.
  - 2. Plaster.
  - 3. Concrete masonry units.
  - 4. Ferrous metals.
  - 5. Gypsum board.
  - 6. Gypsum board ceilings.
- E. Paints and coatings on previously painted surfaces.
- F. See Schedules at end of this Section.

1.02 REFERENCES

- A. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 2007 (Reapproved 2015).
- B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2005 (Reapproved 2017).
- C. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- D. SSPC-SP 2 - Hand Tool Cleaning; 2018.
- E. SSPC-SP 3 - Power Tool Cleaning; 2018.
- F. SSPC-SP 7 - Brush-Off Blast Cleaning; 2007.

1.03 SUBMITTALS

- A. Product Data: Provide data on all finishing products including:
  - 1. Manufacturer name.
  - 2. Product Type.
  - 3. Product Name.
  - 4. Product Number.
  - 5. Color.

1.04 DELIVERY, STORAGE, AND PROTECTION

- 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. Information shall be legible.
- C. Use of off-brand containers or mixing buckets will not be allowed on the site.
- D. 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. Protect from freezing.

1.05 PROJECT CONDITIONS

- 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 or snow, on surfaces coated with frost, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- C. Do not apply exterior coatings in windy and dusty conditions.
- D. Do not apply exterior coatings in direct sunlight or on surfaces which will soon be warmed by the sun.
- E. Application Temperatures for Waterborne Paints: Minimum 45 degrees F for interiors; minimum 50 degrees F for exterior; maximum 90 degrees F (32 degrees C), unless required otherwise by manufacturer's instructions. Maintain interior temperatures until paint is completely dry and cured.
- F. Application Temperatures for Solvent Thinned Paints: Minimum 50 degrees F (10 degrees C) for interiors and exterior; maximum 95 degrees F (35 degrees C), unless required otherwise by manufacturer's instructions. Maintain interior temperatures until paint is completely dry and cured.
- G. Provide lighting level of 80 ft candles measured mid-height at substrate surface.
- H. Ventilation: Ventilate affected areas during paint application. Exhaust solvent vapors outdoors, away from air intakes and people.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS - PAINTS

- A. Benjamin Moore & Co: [www.benjaminmoore.com](http://www.benjaminmoore.com).
- B. PPG Architectural Finishes, Inc.: [www.ppgaf.com](http://www.ppgaf.com).
- C. The Sherwin-Williams Co: [www.sherwin-williams.com](http://www.sherwin-williams.com).

### 2.02 MANUFACTURER - METAL CLEANER

- A. Chemetall Oakite; [www.oakite.com](http://www.oakite.com). metal cleaner

### 2.03 PAINTS AND COATINGS - GENERAL

- A. Do not use insecticides in paint materials

### 2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified; commercial quality.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

### 3.02 PREPARATION

- A. General:
  - 1. Start of the surface preparation or paint materials application will be construed as applicator's acceptance of the surfaces as satisfactory for application of materials.
  - 2. Surface Appurtenances: Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
  - 3. Surfaces: Correct defects and clean surfaces of substances which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

4. Marks: Seal with sealer compatible with primer and finish coats marks which may bleed through surface finishes.
  5. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
  6. Reduce the gloss of glossy surfaces to be painted.
  7. Fill nail holes, cracks, chips, spalls, and similar damaged areas to match adjacent undamaged areas.
  8. Paint Removal:
    - a. Remove flaking, cracking, blistering, peeling or otherwise deteriorated paint and paint failing adhesion testing, by scraping with hand scrapers.
    - b. After scraping, remove large areas of paint on architectural details using sanders, heat guns or heat plates, or chemical paint removers. Do not use flame heat devices.
    - c. When chemical strippers are used, neutralize substrate after stripping to a pH of 5 to 8.5.
    - d. Remove paint to bare substrate or first sound paint layer.
    - e. Paint removal shall not damage or mar the substrate material.
    - f. After paint removal, featheredge and sand edges smooth of remaining chipped paint.
- B. Concrete Surfaces to be Painted:
1. Remove dirt, loose mortar, scale, salt or alkali powder, glaze, efflorescence, laitance, and other foreign matter.
  2. Remove oil and grease with a solution of trisodium phosphate; rinse well and allow to dry.
  3. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
  4. Detergent wash surfaces to receive paint, in accordance with ASTM D4258. Rinse with water and allow to dry.
  5. Allow surfaces to dry at least 30 days before applying paint materials.
  6. Fill concrete surface voids. Dried filler shall be uniform and free of pinholes. Do not apply filler over joint sealers.
- C. Concrete Unit Masonry Surfaces to be Painted:
1. Remove dirt, efflorescence, laitance, and other foreign matter.
  2. Remove oil and grease with a solution of trisodium phosphate; rinse well and allow to dry.
  3. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
  4. Allow surfaces to dry at least 30 days before applying paint materials.
- D. Stucco and Plaster Surfaces to be Painted:
1. Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces.
  2. Wash and neutralize high alkali surfaces.
  3. Allow to age minimum 30 days before painting.
  4. Clean of all loose matter that may affect paint application.
- E. Uncoated Ferrous Metal Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool cleaning in accordance with SSPC-SP 2 or SSPC-SP 3, or abrasive cleaning in accordance with SSPC-SP 7/SSPC SP-7. Clean by washing with detergent or solvent in accordance with SSPC-SP 1. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.
- F. Shop-Primed Ferrous Metal Surfaces to be Finish Painted:
1. Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous.
  2. In flat, exposed surfaces to receive semi-gloss or gloss finish, fill dents, holes and similar voids and depressions in flat exposed surfaces with metal filler compound. Finish flush with adjacent surfaces.



3. Clean surfaces with solvent in accordance with SSPC-SP 1.
  4. Prime bare steel surfaces immediately upon detection.
- G. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent in accordance with SSPC-SP 1 or detergent. Wipe with metal cleaner, rinse, and wipe dry.
- H. Gypsum Board Surfaces to be Painted:
1. Fill minor defects with filler compound. Spot prime defects after repair.
  2. Remove loose dust and dirt by brushing with a soft brush, rubbing with a cloth, or vacuum cleaning. A damp cloth may be used when water based paint materials are to be applied. Allow to dry.
- I. Previously Painted Surfaces:
1. Thoroughly remove all grease, dirt, dust or other foreign matter.
  2. Remove coatings that are blistering, cracking, flaking, peeling, or otherwise deteriorating.
  3. Roughen slick surfaces.
  4. Repair damaged areas such as, but not limited to, nail holes, cracks, chips, and spalls with suitable material to match adjacent undamaged areas.
  5. Feather edge edges of chipped paint, and sand smooth.
  6. Clean metal surfaces in accordance with SSPC requirements using solvent, mechanical, or chemical cleaning methods to provide surfaces suitable for painting. Preparation of ferrous surfaces if not specified shall as recommended by coating manufacturer, but in no case less than SSPC-SP 3.
  7. Chalk shall be removed so that when tested in accordance with ASTM D4214, the chalk resistance rating is no less than 8.

### 3.03 APPLICATION

- A. Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated.
1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
  2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
  3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
- B. Thinning:
1. When thinning is required to suit surface, temperature, weather conditions, or application methods, paints may be thinned in accordance with the manufacturer's directions.
  2. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds.
- C. Do not mix paint materials of different manufacturers.
- D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Minimum Coating Thickness:
1. Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness as recommended by manufacturer. Provide total dry film thickness of the entire system as recommended by manufacturer.
  2. Strip paint to ensure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.

3. Apply each coat of paint so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete. If application thickness or color and opacity of the paint do not achieve complete hiding, apply additional coat(s) to achieve complete hiding without change in contract price.

#### 3.04 INTERIOR WALL AND CEILING JOINTS

- A. Sealant-Type Expansion Joints in Gypsum Wallboard:
  1. Ensure that backer rod and joint sealant (specified in Division 7) are completed and cured prior to application of paint.
- B. Control and Expansion Joints in Concrete and CMU:
  1. Apply coatings to the joint face (approximately 1/2 inch deep) and allow to cure before installing backer and joint sealant specified in Division 7.
- C. Fillet Joints between Hollow Metal Door Frames and Adjacent Walls (and similar locations):
  1. Ensure that backer rod and joint sealant (specified in Division 7) are completed and cured prior to application of paint.

#### 3.05 REPAIR AND RESTORATION

- A. Reinstall electrical plates, hardware, light fixture trim, escutcheons, and fittings that were removed prior to preparing surfaces or finishing.
- B. Restore to original condition surfaces damaged or marred by painting materials application.
- C. Remove, refinish, or repaint work not complying with approved samples and other specified requirements.

#### 3.06 PROTECTION AND CLEANING

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

#### 3.07 SCHEDULE - SURFACES TO BE FINISHED

- A. Do Not Paint or Finish the Following Items:
  1. Items fully factory-finished unless specifically noted.
  2. UL, FMG, or other code required labels; fire rating labels; and equipment name, identification, performance rating, serial number and capacity labels.
  3. Stainless steel items.
- B. Paint the surfaces described in Schedules at the end of this Section and as follows:
  1. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of permanently fixed equipment or furniture, paint surfaces behind permanently fixed equipment or furniture with primer only.
  2. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
  3. Finish exterior field-finished doors on tops, bottoms, and side edges the same as exterior faces.
  4. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
  5. Paint both sides and edges of plywood panel backers for electrical and telephone equipment before installing equipment.

#### 3.08 EXTERIOR PRIMERS

- A. Exterior Alkyd Ferrous Metal Primer:
  1. Benjamin Moore & Co.; P06 Super Spec Alkyd Metal Primer.
  2. PPG Paints; 6-208 Speedhide Rust Inhibitive Steel Primer.
  3. The Sherwin-Williams Co.; Kem Kromik Universal Metal Primer.
- B. Exterior Acrylic Galvanized Metal Primer:
  1. Benjamin Moore & Co.; HP04 Ultra Spec HP Acrylic Metal Primer.
  2. PPG Paints; 90-712 Pitt Tech Acrylic DTM Primer.

3. The Sherwin-Williams Co.; Pro Industrial Pro-Cryl Universal Primer B66W00310 Series.

### 3.09 EXTERIOR FINISH COATS

- A. Gloss Acrylic Finish Coats for Ferrous and Galvanized Metals:
  1. Benjamin Moore & Co.; HP28 Ultra Spec D.T.M. Acrylic Gloss.
  2. PPG Paints; 90-374 Pitt-Tech Int/Ext High Gloss DTM Industrial Enamel.
  3. The Sherwin-Williams Co.; B66 Pro Industrial Acrylic Coating, Gloss.

### 3.10 INTERIOR PRIMERS, SEALERS, AND FILLERS

- A. Interior Acrylic Primer for Concrete and Plaster:
  1. Benjamin Moore & Co.; 608 Ultra Spec Masonry Interior/Exterior 100% Acrylic Sealer (46 g/l).
  2. PPG Paints; 4-603XI PERMA-CRETE Interior/Exterior Alkali Resistant Primer. (88 g/l)
  3. The Sherwin-Williams Co.; A24W300 Loxon Concrete & Masonry Primer/Sealer. (< 50 g/l)
- B. Interior Block Filler for Concrete Masonry Units:
  1. Benjamin Moore & Co.; 571 Ultra Spec Hi-Build Masonry Block Filler. (45 g/l)
  2. PPG Paints; 6-7 Speedhide INT/EXT Latex Masonry Block Filler. (18 g/l)
  3. The Sherwin-Williams Co.; B25W25 PrepRite Acrylic Latex Block Filler. (42 g/l)
- C. Interior Acrylic Primer for Gypsum Board:
  1. Benjamin Moore & Co.; N534 Ultra Spec 500 Interior Latex Primer. (0 g/l)
  2. PPG Paints; 6-4900XI Speedhide Zero VOC Interior Primer. (0 g/l)
  3. The Sherwin-Williams Co.; B28W02600 ProMar 200 Zero VOC Interior Latex Primer. (0 g/l)
- D. Interior Acrylic Primer for Ferrous Metal:
  1. Benjamin Moore & Co.; HP04 Ultra Spec HP Acrylic Metal Primer. (48 g/l)
  2. PPG Paints; 90-712 Pitt-Tech Primer/Finish DTM Industrial Enamel. (123 g/l)
  3. The Sherwin-Williams Co.; B66W1 Direct To Metal Acrylic Primer & Finish. (138 g/l)

### 3.11 INTERIOR FINISH COATS

- A. Flat Acrylic Finish Coats for Concrete, Plaster, Concrete Masonry Units, Gypsum Board, Wood:
  1. Benjamin Moore & Co.; N536 Ultra Spec 500 Interior Flat. (0 g/l)
  2. PPG Paints; 6-4110XI Speedhide Zero VOC Flat Interior Latex. (0 g/l)
  3. The Sherwin-Williams Co.; ProMar 200 Zero VOC Flat, B30-2600. (0 g/l)
- B. Eggshell Acrylic Finish Coats for Concrete, Plaster, Concrete Masonry Units, Gypsum Board, Wood:
  1. Benjamin Moore & Co.; N538 Ultra Spec 500 Interior Eggshell. (0 g/l)
  2. PPG Paints; 6-4310XI Speedhide Zero VOC Interior Eggshell Latex. (0 g/l)
  3. The Sherwin-Williams Co.; ProMar 200 Zero VOC Eg-Shel, B20-2600. (0 g/l)
- C. Gloss Acrylic Finish Coats for Ferrous Metal:
  1. Benjamin Moore & Co.; HP28 Ultra Spec D.T.M. Acrylic Gloss. (142 g/l)
  2. PPG Paints; 90-374 Pitt-Tech Waterborne Acrylic Gloss Industrial Enamel. (191 g/l)
  3. The Sherwin-Williams Co.; B66 Pro Industrial Acrylic Coating, Gloss. (0 g/l)

### 3.12 PRIMER, INTERMEDIATE, AND TOP COAT COLORS

- A. Except where coating materials cannot be tinted, tint each successive (primer, intermediate, top) coat of paint a sufficiently contrasting color to facilitate identification of complete coating coverage. The preceding coat may be in the same color family, but shall be noticeably different. Provide additional top coats without change in Contract Price if necessary to achieve complete hiding and uniform sheen.
- B. Top coat colors are indicated on the drawings and schedules. For approval of actual colors, see sample and mock-up requirements specified above.

- C. Top coat colors of manufacturers listed on the Finish Schedule (or elsewhere) indicate the required color, only, and do not indicate the required brand name product, which shall be as specified in above.
- D. Top Coat Colors:
  - 1. Before submitting samples for approval and before purchasing project quantities of material, confirm with the Architect that colors have not changed based on awarded flooring, tile, and countertop finishes.

### 3.13 PAINT SYSTEMS - EXTERIOR

- A. Ferrous Metals:
  - 1. First Coat: Alkyd ferrous metal primer.
  - 2. Two Top Coats: Gloss acrylic finish.
- B. Galvanized Metal:
  - 1. First Coat: Acrylic galvanized metal primer.
  - 2. Two Top Coats: Gloss acrylic finish.

### 3.14 PAINT SYSTEMS - INTERIOR

- A. Concrete and Plaster:
  - 1. First Coat: Acrylic primer.
  - 2. Two Top Coats: Eggshell acrylic finish.
- B. Concrete Masonry Units:
  - 1. First Coat: Acrylic Block Filler.
  - 2. Two Top Coats: Eggshell acrylic finish.
- C. Ferrous Metals:
  - 1. First Coat: Primer.
  - 2. Two Top Coats: Gloss acrylic finish.
- D. Gypsum Board:
  - 1. First Coat: Acrylic primer.
  - 2. Two Top Coats: Eggshell acrylic enamel finish.
- E. Gypsum Board Ceilings:
  - 1. First Coat: Acrylic primer.
  - 2. Two Top Coats: Flat latex paint finish.

END OF SECTION



## SECTION 10 11 01 - VISUAL DISPLAY BOARDS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Factory Assembled Units:
  - 1. Markerboards.
  - 2. Sliding Markerboards.

#### 1.02 REFERENCES

- A. ASTM A 424 - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2006.
- B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2007.

#### 1.03 SUBMITTALS

- A. Product Data: Provide manufacturer's data on products specified.
- B. Selection Samples: Submit manufacturer's complete set of color samples for each product specified.
- C. Verification Samples: Submit two samples 2 by 2 inches in size illustrating materials, finish, color, and texture of each product specified.
- D. Manufacturer's printed installation instructions.
- E. Maintenance Data: Manufacturer's cleaning and maintenance instructions covering both routine and long-term operations.
- F. Shop Drawings:
  - 1. Include types of units provided, location within each room, and size of each unit.
  - 2. Include dimensioned elevation drawings of each board assembly indicating joint locations and type of joint where required, and board mounting distances from floors.
  - 3. Include cross-section details showing each type of product and components; trim, marker/chalk tray, face, core, backing materials and thickness, and key to elevations.
  - 4. Show locations and quantities of accessories.
  - 5. Show anchorage and installation details.
- G. Warranty: Executed copy of manufacturer's warranty.

#### 1.04 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain visual display boards of each type from a single source.
- B. Manufacturer shall be a firm engaged in the manufacture of visual display boards in the United States.
- C. Operation and Maintenance: Include data on regular cleaning, stain removal, and precautions.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Claridge Products: [www.claridgeproducts.com](http://www.claridgeproducts.com).
- B. Platinum Visual Systems: [www.pvsusa.com](http://www.pvsusa.com).
- C. Egan Visual: [www.egan.com](http://www.egan.com)

#### 2.02 MATERIALS

- A. Writing Surface: ASTM A 424, Type I, Porcelain enamel on steel.
  - 1. Metal Face Sheet Thickness: 0.024 inch (24 gage).
  - 2. Hardboard Face Sheet Thickness: 7/16 min. inch.
- B. Core:
  - 1. Single Unit Core: Particleboard laminated to face sheet.

2. Spliced Unit Core: MDF laminated to face sheet.
  3. Backing: 0.005 inch thick aluminum foil, laminated to core.
- C. Frame: T5 tempered 6063 alloy extruded aluminum, with concealed fasteners.
- D. Accessories:

### 2.03 FACTORY ASSEMBLED UNITS

- A. Factory-assembled units in a single frame, of materials specified above.
- B. Products:
1. Basis of Design: Claridge Products: Series 8.
    - a. Markerboard: Gloss finish; Color 32 White .
  2. Horizontal Sliding Markerboard:
    - a. Basis of Design: Claridge Products: Horizontal Sliding Units, 2-Track System.
      - 1) Markerboard: Gloss finish; Color 32 White.
      - 2) Panel Size:
        - (a) 2-Panel: HS46 (4' x 6').
        - (b) 3 Panel: HS48 (4' x 8').
      - 3) Trim Finish: Satin anodized.
      - 4) Top mounted sliding panels with 2-track guide channels, no housing, and no back panel.
      - 5) Provide Facia and trim as indicated on drawings.
      - 6) No map rail. No marker holder.
      - 7) Coordinate installation with Laboratory Casework installer.

### 2.04 FACTORY ASSEMBLED UNIT FABRICATION

- A. Laminate facing sheet and backing sheet to core material under pressure, using manufacturer's recommended adhesive.
- B. Where butt jointed spliced panels are required use MDF core.
- C. Provide factory-assembled visual display boards, except where sizes demand partial field assembly.
- D. Assemble units in one piece without joints, wherever possible. Where required dimensions exceed maximum panel size available, provide two or more pieces of equal length, as indicated on approved shop drawings. Assemble to verify fit at factory, then disassemble for delivery and final assembly at project site.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated on drawings.
- B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as instructed by manufacturer.

### 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure units level and plumb.

### 3.03 CLEANING

- A. Clean board surfaces in accordance with manufacturer's instructions.

END OF SECTION

SECTION 10 11 46 - WRITEABLE VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Dry erase projection surface.
- B. Accessories.

1.02 REFERENCES

- A. GA-214 - Recommended Levels of Gypsum Board Finish; Gypsum Association; 2007.

1.03 SUBMITTALS

- A. Manufacturer's product data and installation instructions for each type of dry erase surface, adhesive and accessories required.
- B. Manufacturer's written installation instructions.
- C. Manufacturer's written instructions for recommended maintenance of each type of dry erase wallcovering required.
- D. Closeout Submittals: Warranty.

1.04 QUALITY ASSURANCE

- A. Manufacturer: Provide each type of dry erase wallcovering required produced by one manufacturer.
- B. Applicator: Installation by skilled commercial wallcovering applicators with no less than three years of documented experience installing dry erase wallcovering of the types and extent required.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver presentation surfaces to the project site in unbroken and undamaged original factory wrappings and clearly labeled with the manufacturer's identification label, quality or grade, and lot number.
- B. Store materials in a clean, dry storage area with temperature maintained above 55 degrees F with normal humidity.
- C. Store material in a flat position to prevent damage to roll ends. Do not cross stack material. Support material off the floor in a manner to prevent sagging and warping.

1.06 PROJECT CONDITIONS

- A. Do not apply presentation wallcoverings when surface and ambient temperatures are outside the temperature ranges required by the wallcovering manufacturer.
- B. Provide continuous ventilation and heating facilities to maintain substrate surface and ambient temperatures above 55 degrees F unless required otherwise by manufacturer's instructions.
- C. Apply adhesive when substrate surface temperature and ambient temperature is above 55 degrees F and relative humidity is below 40 percent.
- D. Maintain constant recommended temperature and humidity for at least 72 hours prior to and throughout the installation period, and for 72 hours after wallcovering installation completion.
- E. Provide not less than an 80 foot-candles per square foot lighting level measured mid-height at substrate surfaces.

1.07 WARRANTY

- A. Submit manufacturer's limited five-year written warranty against manufacturing defects.

1.08 MAINTENANCE

- A. Maintenance instructions: Include precautions against cleaning materials and methods that may be detrimental to finishes and performance.



## PART 2 - PRODUCTS

### 2.01 SUBSTITUTIONS

- A. Refer to Section 01 6000 - Product Requirements.

### 2.02 MANUFACTURER

- A. Basis of Design; Owner Preferred Alternate: Da-Lite Idea Screen, Milestone AV Technologies: [www.milestone.com](http://www.milestone.com)
- B. Other Acceptable Manufacturers:
  - 1. MDC Wallcoverings, Inc.: [www.mdcwall.com](http://www.mdcwall.com)
  - 2. Wolf Gordon: [www.wolfgordon.com](http://www.wolfgordon.com)
  - 3. Walltalkers Wallcoverings manufactured by RJF International Corporation,: [korseal.com](http://korseal.com)

### 2.03 MATERIALS

- A. Dry erase projection board: Smooth low gloss surface for projection and dry erase markers.
  - 1. Product:
    - a. Da-Lite Idea Screen, 16:9 format, 60-inch height x 89-inch long, writeable, erasable magnetic backed projection screen.
    - b. Frame: 1-inch thick with a 3/8-inch bezel; aluminum with a silver finish
    - c. Color: White
    - d. Tray: 24-inch
- B. Dry erase projection wallcoverings: Smooth low gloss vinyl surface for projection and dry erase markers.
  - 1. Product:
    - a. Walltalkers eraserite, ER60: 60-inch width, 17 ounces per square yard, non-woven backing.
    - b. Color: White.
    - c. Frame/Trim: Clear anodized aluminum with snap on trim clips.
    - d. Tray: Clear anodized snap on marker tray with anodized aluminum end caps.

### 2.04 ACCESSORIES

- A. Adhesives: Heavy-duty clear premixed vinyl adhesive or clay based adhesive.
- B. Substrate Primer/Sealer: White pigmented acrylic base primer/sealer specifically formulated for use with vinyl wallcoverings.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates and installation conditions to ensure surface conditions meet manufacturers recommended level of finish. At Wall Covering Type surfaces provide or exceed a Level 4 finish, GA-214, Recommended Levels of Gypsum Board Finish and comply with the following:
  - 1. Test substrates with a suitable moisture meter and verify that moisture content does not exceed 4 percent.
    - a. Verify substrate surfaces are clean, dry, smooth, structurally sound and free from surface defects and imperfections that would show through the finished surface.
    - b. Evaluate all painted surfaces for the possibility of pigment bleed-through.
    - c. Notify the Architect in writing of any conditions detrimental to the proper and timely completion of the installation.
    - d. Beginning of installation means acceptance of surface conditions.

### 3.02 DRY ERASE PROJECTION BOARD INSTALLATION

- A. Install projection board in accordance with manufacturer's written instructions.
- B. Install projection boards plumb and level.
- C. Accurately fit, align, securely fasten and install free from distortion or defects.

### 3.03 WALL COVERING INSTALLATION

- A. Acclimate wallcovering in the area of installation a minimum of 24 hours before installation.
- B. Examine all materials for pattern, color, quantity and quality as specified for the correct location prior to cutting.
- C. Use specified adhesive.
- D. Install each strip in the same sequence as cut from the roll.
- E. Install dry erase wallcovering panels in exact order as they are cut from bolt. Reverse hang alternate strips. Do not crease or bend the wallcovering when handling.
- F. Install dry erase wallcovering horizontally using a level line. Using level or straight edge, double cut the seam with a new razor or knife.
- G. Smooth wallcovering to the hanging surface using a wallcovering smoother, wrapped with a soft cloth, to eliminate air bubbles, wrinkles, gaps and overlaps. Do not use sharp edged smoothing tools. Smooth material on the wall from the middle to the outside edge.
- H. Remove excess adhesive along finished seams immediately after each wallcovering strip is applied. Clean entire surface with warm, mild soap solution, a natural sponge and clean towels. Rinse thoroughly with water and let dry before using. Change water often to maintain water cleanliness.
- I. Stop installation of material that is questionable in appearance and notify the manufacturer's representative for an inspection.

### 3.04 CLEAN-UP

- A. Upon completion of installation, remove all exposed adhesive immediately using a natural sponge and a warm, mild soap solution and rinse thoroughly with water and dry with clean towel prior to using.
- B. Upon completion of the work, remove surplus materials, rubbish and debris resulting from the wallcovering installation. Leave areas in neat clean and orderly condition.

END OF SECTION



## SECTION 10 21 26 - INDUSTRIAL CURTAINS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Surface mounted overhead metal curtain track and guides.
- B. Laser Curtains.
- C. Blackout Curtains.

#### 1.02 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.
- B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; National Fire Protection Association; 2010.

#### 1.03 SUBMITTALS

- A. Product Data: Provide data for curtain fabric characteristics and performance characteristics..
- B. Shop Drawings: Indicate a reflected ceiling plan view of curtain track, hangers, overhead suspension system and suspension points, attachment details, schedule of curtain sizes.
- C. Provide shop drawing of overhead support sealed by a professional engineer licensed in the state in which the project is located.
- D. Samples: Submit two fabric samples, 12x12 inch in size illustrating fabric color.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- F. Maintenance Data: Include recommended cleaning methods and materials and stain removal methods.

#### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Accept curtain materials on site and inspect for damage.
- B. Store curtain materials on site and deliver to Owner for installation when requested.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Laser Safety Curtains:
  - 1. Lase-R Shield Inc; Product LB300 Laz-R-Shroud; [www.lase-rshield.com](http://www.lase-rshield.com).
  - 2. Wilson Laser Barriers; Product Laz-R-Barrier SEN 500; [www.wilsonindustries.com](http://www.wilsonindustries.com).
  - 3. Rockwell Laser Industries; Product Series 300; [www.rli.com](http://www.rli.com).
- B. Blackout Curtains:
  - 1. A. R. Nelson Co; Product Blackout Curtains: [www.arnelson.com](http://www.arnelson.com).
  - 2. Blackout Curtains; Product Blackout Curtains: [www.blackoutcurtains.com](http://www.blackoutcurtains.com).
  - 3. Imperial Fastener Co., Inc; Product Blackout Curtains: [www.imperialfastener.com](http://www.imperialfastener.com).

#### 2.02 TRACKS AND TRACK COMPONENTS

- A. Track: Formed steel sections; one piece per cubicle track run; C-Channel profile.
  - 1. Structural Performance: Capable of supporting vertical test load of 50 lbs without visible deflection of track or damage to supports, safely supporting moving loads, and sufficiently rigid to resist visible deflection and without permanent set.
  - 2. Track End Stop, Tees, Y's, and Switches: To fit track section.
  - 3. Track Bends: Minimum 24 inch radius; fabricated without deformation of track section or impeding movement of carriers.

4. Suspension Rods: Tubular Aluminum sections, sized to support design loads and designed to receive attachment from track and ceiling support.
  5. Escutcheons to Suspension Rods: Aluminum.
  6. Finish on Exposed Surfaces: Clear anodized finish.
- B. Curtain Carriers: Steel roller to accurately fit track; designed to eliminate bind when curtain is pulled; fitted to curtain to prevent accidental curtain removal; 5 carriers per foot of track length.
- C. Mounting: Curtain and track to be mounted to structure above using threaded rod and connectors to support curtain and track at ceiling. Manufacture to provide details and requirements for mounting curtain at acoustical ceilings tiles. Curtain and track are to be supported independently from ceiling

### 2.03 LASER CURTAINS

- A. Curtain Material:
1. Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
- B. Color: Black
- C. Performance:
1. Barrier to withstand laser exposures at irradiance levels incident on the barrier which do not exceed 350 W/CM<sup>2</sup> for beam sizes of 5 mm for time period of 100 seconds or less.
  2. Provide exposure control as defined by ANSI Z136.1 standard for safe use of lasers.
  3. Curtain Fabrication:
    - a. Manufacture curtains of one piece, sized 10 percent wider than track length. Terminate curtain 0.25 inches from floor.
    - b. Curtain Heading: Triple thickness 2 inches wide, with stitched button holes for carriers 6 inches on center, double fold bottom hem 2 inches wide with lead weights included. Lock stitch seams in two rows. Turn seam edges and lock stitch.
    - c. Grommets: Stainless Steel.
    - d. Valance: 12" high fixed valance with velcro attachment to track.
    - e. Wall attachment: Velcro.
    - f. Joining Edges: Velcro with overlap.
  4. Signage: Provide Plastic signage pockets to accept laser warning signage.

### 2.04 BLACKOUT CURTAINS

- A. Curtain Materials:
1. Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
- B. Curtain: Blackout fabric with 100% blackout.
- C. Color: Black / Black.
- D. Curtain Fabrication:
1. Manufacture curtains of one piece, sized 10 percent wider than track length. Terminate curtain 0 (zero) inches from floor.
  2. Curtain Heading: Triple thickness 2 inches wide, with stitched button holes for carriers 6 inches on center, double fold bottom hem 2 inches wide with lead weights included. Lock stitch seams in two rows. Turn seam edges and lock stitch.
  3. Grommets: Stainless Steel.
  4. Valance: 12" high fixed valance with velcro attachment to track.
  5. Wall attachment: Velcro.
  6. Joining Edges: Velcro with overlap.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that surfaces and supports above ceiling are ready to receive work of this Section.

- B. Verify that field measurements are as indicated.

### 3.02 INSTALLATION

- A. Install curtain track to be secure, rigid, and true to ceiling line.
- B. Install end cap and stop device.
- C. Suspend track from ceiling system.
- D. Install curtains on carriers ensuring smooth operation.

END OF SECTION



## SECTION 10 22 13 - WIRE MESH PARTITIONS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Chain Link mesh systems for walls.

#### 1.02 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2018.

#### 1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for mesh materials, finishes.
- C. Shop Drawings: Indicate plan and vertical dimensions, elevations, component details; head, jamb, and sill details; location of hardware. Provide component details, anchorage, and type and location of fasteners.
- D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

#### 1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

### PART 2 PRODUCTS

#### 2.01 CHAIN LINK PARTITIONS

- A. Chain Link Partitions: Factory-fabricated modular assemblies of panels, doors, anchors, hardware, and accessories as required to provide a complete system.
  - 1. Design Criteria:
    - a. Design partition system to provide for movement of components without damage, undue stress on fasteners or other detrimental effects, when subject to design loads.
    - b. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
  - 2. Performance:
    - a. Installed Wall Assembly: Resist a lateral load of 250 lbs without damage or permanent set.
    - b. Hinged Door and Panel in Open Position: Resist a downward load of 250 lbs without damage or permanent set.

#### 2.02 COMPONENTS

- A. Chain Link Fencing: Wire fabric, posts, rails, and frames.
  - 1. Material: ASTM A392, Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
  - 2. Fabric: 2 inch diamond mesh interwoven wire, 9 gauge, 0.1483 inch thick, top selvage knuckle end closed, bottom selvage twisted tight.
  - 3. Corner and Terminal Posts: 2.38 inch diameter.
  - 4. Line Posts: 1.9 inch diameter.
  - 5. Tension Wire: 6 gauge, 0.1920 inch thick steel, single strand.
  - 6. Tie Wire: Aluminum alloy steel wire.
- B. Framing and Support Members:



1. Material: ASTM A36/A36M steel shapes and ASTM A500/A500M cold-formed steel.
  2. Framing, Corner Posts, and Intermediate Support Members: Manufacturer's standard sizes for system specified and as indicated on drawings.
- C. Doors: Same material as partitions, fully framed; manufacturer's standard construction and hardware for 180 degree swing operation.
1. Locking: Integrated padlock hasps for padlocks provided by Owner.

#### 2.03 FASTENERS

- A. Bolts, Nuts and Washers: Hot dip galvanized.
- B. Anchorage Devices: Provide Epoxy anchors.

#### 2.04 ACCESSORIES

- A. Bracing: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.
- B. Plates, Gussets, Clips: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.
- C. Post Caps: Manufacturer's standard.
- D. Floor and Ceiling Pilaster Shoe: Manufacturer's standard.
- E. Floor Base: Manufacturer's standard.

#### 2.05 FINISHES

- A. Galvanized Finish: In accordance with requirements of ASTM A123/A123M.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that substrate surfaces and required openings are ready to receive work.

#### 3.02 PREPARATION

- A. Clean substrate surfaces.

#### 3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install items plumb and level, accurately fitted, free from distortion or defects.

#### 3.04 TOLERANCES

- A. Maximum Variation From Plumb or Level: 1/4 inch.
- B. Maximum Misalignment From True Position: 1/4 inch.

#### 3.05 ADJUSTING

- A. Adjust doors to achieve free movement.

END OF SECTION

SECTION 10 23 10 - GLAZED INTERIOR WALL AND DOOR ASSEMBLIES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes fixed, frameless glass panel partitions with glass doors.

1.02 REFERENCE STANDARDS

- A. American Architectural Manufacturers Association (AAMA): [www.aama.org](http://www.aama.org):
1. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum
- B. ASTM International (ASTM): [www.astm.org](http://www.astm.org):
1. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
  2. ASTM B221/ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
  3. ASTM C1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
  4. ASTM C1172 Standard Specification for Laminated Architectural Flat Glass
  5. ASTM E90 Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
  6. ASTM E413 Classification for Rating Sound Insulation
  7. ASTM E557 Guide for the Installation of Operable Partitions
- C. Builders Hardware Manufacturers Association (BHMA): [www.buildershardware.com](http://www.buildershardware.com):
1. ANSI/BHMA A156 Series
- D. Code of Federal Regulations
1. 16 CFR 1201 Safety Standard for Architectural Glazing Materials
- E. U.S. Architectural & Transportation Barriers Compliance Board: [www.access-board.gov](http://www.access-board.gov):
1. Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. Coordinate installation of glass panel partitions with installation of floor, wall, and ceiling construction to comply with substrate tolerance requirements of partition manufacturer.
  2. Coordinate installation of anchors and secondary structural members indicated on approved glass panel partition shop drawings and specified in other sections.
- B. Preinstallation Conference: Conduct conference at Project Site.

1.04 SUBMITTALS

- A. Product Data: For each glass panel partition and door component specified, including:
1. Glass panels.
  2. Frame and sill tracks.
  3. Door hardware and accessories.
- B. Shop Drawings: For fixed glass panel partitions.
1. Include plans, elevations, sections, and details. Provide numbered panel installation sequence.
  2. Show locations and requirements for tracks, bracing, blocking, and attachments to other work.
  3. Field Measurements.
  4. Bracing.
  5. Shop drawings shall bear the seal of a professional engineer licensed in the State in which the Project is located.

- C. Samples for Verification: For each exposed component including hardware, for each color and finish selected, of size indicated below:
  - 1. Glass: Units 12 inches (300 mm) square.
  - 2. Exposed Frame, Track, and Sill Members: Not less than 6 inches (150 mm) long.
  - 3. Hardware: One of each type of exposed door hardware finish.

#### 1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified installer.
- B. Warranty: Sample of unexecuted manufacturer warranty.

#### 1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Experienced Installer equipped and trained for installation of glass panel partitions required for this Project with record of successful completion of not less than five projects of similar scope.
- B. Single Source Responsibility: Provide glass panel partitions and associated hardware by a single manufacturer through a single source.
- C. Mockups: Provide mockup consisting of initial sections of tracks, frames, and glass panels with operating doors and hardware, in location as directed by Architect. Proceed with work upon approval of mockup by Architect.

#### 1.07 WARRANTY

- A. Special Manufacturer's Warranty: Standard form in which manufacturer agrees to repair or replace components of glass panel partitions that demonstrate deterioration or faulty operation due to defects in materials or workmanship under normal use within warranty period specified.
  - 1. Warranty Period: Five years date of Final Acceptance.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Basis-of-Design Product: Provide PURE Frameless glass panel partitions with glass doors, manufactured by DORMA USA, Inc.; (800) 523-8483; email: [specification@dorma-usa.com](mailto:specification@dorma-usa.com); website: [www.dorma.com](http://www.dorma.com).
- B. Other Acceptable Manufacturers:
  - 1. Avanti Systems "Solare"; [www.avantisystemsusa.com](http://www.avantisystemsusa.com)
  - 2. Nello Wall Systems; [www.nellowall.com](http://www.nellowall.com)
  - 3. Transwall; [www.Transwall.com](http://www.Transwall.com)

### 2.02 GLASS PANEL PARTITIONS

- A. Fixed Glass Panel Partitions: Frameless glass panel partition with top track and bottom sill guide, with butt-glazed dry joint between panels, and equipped with doors where indicated.
  - 1. Basis of Design: DORMA, PURE.
  - 2. Sound Transmission Class (STC), ASTM E 90 and Outdoor-Indoor Transmission Class (OITC), ASTM E1332:
    - a. Framed partition with 12.0 mm thick laminated glass: STC 33; OITC 30.
    - b. Swinging door with 12.0 mm thick laminated glass: STC 15; OITC 15.
  - 3. Partition Top Track: Aluminum extrusion, low-profile.
  - 4. Sill Guide: Aluminum extrusion.

### 2.03 GLASS PANELS AND DOORS

- A. Glass Panels, General: Provide glass panels that comply with 16 CFR 1201, Category II requirements for safety glazing. Permanently mark glazing with certification label of the SGCC.
  - 1. Glass and Door Panel Thickness: Thickness required for size of panel based upon manufacturer's written recommendations, but not less than 12 mm.
- B. Fully Tempered Clear Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality-Q3.

1. Thickness: 12.0 mm.
  - C. Laminated Fully Tempered Clear Float Glass: ASTM C1172; consisting of two plies of 6 mm. thick glass with interlayer of 0.060-inch-thick clear polybutyral; unit thickness 12.7 mm.
    1. Fully Tempered Clear Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality-Q3.
  - D. Frosted Product where indicated on the Drawings: Match the Architect's sample.
- 2.04 SLIDING DOORS
- A. Accessibility Standard: Comply with applicable provisions in ADA-ABA Accessibility Guidelines for Buildings and Facilities.
  - B. Doors: Glass panel matching partition panel material and thickness, of size indicated on Drawings.
  - C. Sliding Door Track: Extruded aluminum track designed for operation, size, and weight of glass panel door, with factory-finished head closure trim and seals as required for acoustical performance indicated.
  - D. Track Mounting:
    1. Ceiling recess-mounted.
  - E. Door Panel Carriers: Trolley system designed for operation, size, and weight of glass panel door, with ball-bearing wheels.
  - F. Manual Sliding Door Operation:
    1. Single door with regulated sliding and cushioned close.
      - a. Basis of Design: DORMA PURE with SoftClose.
- 2.05 MATERIALS
- A. Aluminum: ASTM B221 (ASTM B221M), with strength and durability characteristics of not less than Alloy 6063-T5.
  - B. Stainless Steel: ASTM A666, Type 304.
  - C. Concealed Overhead Steel Structure: ASTM A 36/A 36M.
  - D. Panel to Panel Sealant: Clear silicone, Dowsil.
  - E. Concealed Perimeter Sealant: Urethane complying with Section 07 9000 - Joint Sealers.
- 2.06 FINISHES
- A. Aluminum Finish:
    1. Clear anodic finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
  - B. Stainless Steel Finishes: No. 4 directional satin finish.
- 2.07 DOOR HARDWARE AND FITTINGS
- A. Door Hardware, General: All-glass door hardware units in types, sizes, quantities, and mounting locations recommended by manufacturer for glass door types, sizes, and operation. For exposed components, match metal and finish of exposed partition fittings unless otherwise noted.
  - B. Locking Ladder Pull: Pair of tubular lockable pull handles with thumb turns, Grade 316L stainless steel, accommodating key cylinder, with floor-recessed deadbolt or head-mounted deadbolt.
    1. Basis of Design: DORMA, TG138 Locking Ladder Pulls.
    2. Unit Length:
      - a. 49 inches.
  - C. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver; BHMA A156.5, Grade 1, permanent removable cores; with face finish matching lockset, keyed to master key system.
    1. See additional requirements in 08 7100 - Door Hardware.

- D. Accessory Fittings: Overhead doorstop.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Examine partition substrates to determine if work is within glass panel partition manufacturer's required tolerances and ready to receive work. Proceed with installation of partitions once conditions affecting installation and performance of partitions meet manufacturer's requirements.
- B. Verify that partition construction adjacent to acoustically-rated glass panel partitions complies with requirements of ASTM E557.

#### 3.02 PARTITION INSTALLATION

- A. General: Comply with glass panel partition manufacturer's written installation instructions and approved shop drawings.
- B. Install glass panel partitions after other finishing operations have been completed.
- C. Set units level, plumb, and true to line, with uniform joints.
- D. Fasten glass panel partition track and sill to building structure and supports as indicated on approved shop drawings, utilizing approved fasteners and spacing.
- E. Set, seal, and grout floor closer cases.
- F. Seal between perimeter extrusions and adjacent construction.

#### 3.03 ADJUSTING

- A. Adjust door closers to required timing and force.
- B. Adjust latches and locks for smooth operation.
- C. Test and adjust hardware linked to access control system.
- D. Replace damaged panels and accessories.

#### 3.04 CLEANING

- A. Clean glass panels in accordance with glass manufacturer's written instructions. Do not use cleaning agents or methods not approved by glass manufacturer.
- B. Clean exposed metal surfaces to factory new appearance.

END OF SECTION

SECTION 10 44 00 - FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.

1.02 REFERENCES

- A. UL (DIR) - Online Certifications Directory; Current Edition.

1.03 PERFORMANCE REQUIREMENTS

- A. Provide extinguishers classified and labeled by testing firm acceptable to the Fire Marshall for the purpose specified and indicated.

1.04 SUBMITTALS

- A. Product Data.
- B. Maintenance Data: Include test, refill, or recharge schedules and re-certification requirements.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

- A. Refer to Section 01 60 00 - Product Requirements.

2.02 MANUFACTURERS

- A. Fire Extinguishers, Cabinets and Accessories:
  - 1. JL Industries, Inc.: [www.jlindustries.com](http://www.jlindustries.com).
  - 2. Larsen's Manufacturing Co.: [www.larsensmfg.com](http://www.larsensmfg.com).
  - 3. Potter-Roemer: [www.potterroemer.com](http://www.potterroemer.com).

2.03 FIRE EXTINGUISHERS

- A. Provide units labeled by UL (DIR).
- B. Dry Chemical Multi-Purpose Type: Steel cylinder.
  - 1. Size: 4A60BC.
  - 2. Diameter: 5 inches.
  - 3. Finish: Powder coat, red color.

2.04 CABINETS FOR DRY TYPE MULTI-PURPOSE FIRE EXTINGUISHERS

- A. Style: Vertical Duo.
- B. Semi-recessed (non-fire-rated box):
  - 1. Exterior nominal dimensions of 12 inches wide x 27 inches high x 6 inches deep.
  - 2. Finish: Stainless Steel.
    - a. J.L.; Cosmopolitan 1037 (3 inch projection).
    - b. Larsen's; Architectural SS2409-6R (2-1/2 inch projection).
    - c. Potter-Roemer; Alta SS 7062 DV (2 inch projection).
- C. Door: 0.036 inch thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with continuous piano hinge. Provide nylon catch.
- D. Door Glazing: Tempered Glass, clear, 1/8 inch thick float. Set in resilient channel gasket glazing.
- E. Finish of Cabinet Interior: White enamel.
- F. Cabinet Signage: FIRE EXTINGUISHER in black vertical letters parallel to vertical-duo window.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level, 34 inches from finished floor to inside bottom of cabinet.
- C. Secure rigidly in place.

END OF SECTION

SECTION 12 21 13 - HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Horizontal slat louver blinds.
- B. Operating hardware.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating physical and dimensional characteristics.
- C. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.
- D. Samples: Submit two samples, two inch long illustrating slat materials and finish, cord type and color.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.03 QUALITY ASSURANCE

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Horizontal Louver Blinds Without Side Guides:
  - 1. Hunter Douglas Architectural; CD Model: [www.hunterdouglasarchitectural.com/#sle](http://www.hunterdouglasarchitectural.com/#sle).
  - 2. Levolor; Metal Blinds: [www.levolor.com/commercial/#sle](http://www.levolor.com/commercial/#sle).
  - 3. SWFcontract, a division of Spring Window Fashions, LLC; \_\_\_\_:  
[www.swfcontract.com/#sle](http://www.swfcontract.com/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 BLINDS WITHOUT SIDE GUIDES

- A. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail.
- B. Manual Operation: Control of raising and lowering by cord with full range locking; blade angle adjustable by control wand.
- C. Metal Slats: Spring tempered pre-finished aluminum; square slat corners, with manufacturing burrs removed.
  - 1. Width: 1 inch.
  - 2. Color: Match existing with manufacturers standard color selection.
- D. Slat Support: Woven polypropylene cord, ladder configuration.
- E. Head Rail: Pre-finished, formed aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.
  - 1. Color: Same as slats.
- F. Control Wand: Extruded hollow plastic; hexagonal shape.
  - 1. Non-removable type.
  - 2. Length of window opening height less 3 inch.
  - 3. Color: Clear.
- G. Headrail Attachment: Wall brackets.
- H. Accessory Hardware: Type recommended by blind manufacturer.



2.03 FABRICATION

- A. Determine sizes by field measurement.
- B. Fabricate blinds to fit within openings with uniform edge clearance of 1/8 inch.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install blinds in accordance with manufacturer's instructions.
- B. Secure in place with flush countersunk fasteners.

3.02 TOLERANCES

- A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch.
- B. Maximum Offset From Level: 1/8 inch.

3.03 ADJUSTING

- A. Adjust blinds for smooth operation.

3.04 CLEANING

- A. Clean blind surfaces just prior to occupancy.

END OF SECTION

## SECTION 12 24 13 - WINDOW SHADE SYSTEMS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Manually-operated window shades and accessories.

#### 1.02 SUBMITTALS

- A. Product Data: Manufacturer's catalog data, product descriptions, installation instructions, detail sheets, and specifications for each type system specified.
  - 1. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, and instructions for operating hardware and controls.
- B. Samples for Verification: Shade fabric sample and paint finish as selected.
- C. Shop Drawings: Show dimensions and interface with other products.
  - 1. Room schedule including field-verified dimensions of each opening to receive window shade system.
  - 2. Use same room designations as indicated on Drawings. Key to typical mounting details.
  - 3. Indicate model number, operator, fabric selection, and mounting type.
  - 4. Indicate control type and provide zone schedule if necessary.
- D. Closeout Submittals:
  - 1. Warranty.

#### 1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience installing products comparable to those specified in this section.
- B. Mock-up: Provide a mock-up of each window shade system for evaluation of mounting, appearance and accessories.
  - 1. Mock-up may remain as part of the work.
  - 2. Locate mock-up in window designated by the Architect.
  - 3. Do not proceed with remaining work until, mock-up is accepted by the Architect.

#### 1.04 WARRANTY

- A. Roller shade hardware, chain and shade fabric: Manufacturer's standard warranty.

#### 1.05 PROJECT CONDITIONS

- A. Environmental Limitations: Install roller shades after finish work, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for project when occupied for its intended use.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project site in manufacturer's original cartons.
- B. Individually package and mark shades with room number and opening number.
- C. Inspect the materials upon delivery to assure that specified products have been received.
- D. Store and handle shades to prevent damage to fabrics, finishes, and operators prior to installation.

### PART 2 PRODUCTS

#### 2.01 SUBSTITUTIONS

- A. Refer to Section 01 60 00 - Product Requirements.

#### 2.02 MANUFACTURERS

- A. Mechoshade: [www.mechoshade.com](http://www.mechoshade.com).
- B. Levolor Commercial; [commercial.levolor.com](http://commercial.levolor.com)

C. Hunter Douglas Architectural: [www.HunterDouglasArchitectural.com](http://www.HunterDouglasArchitectural.com)

## 2.03 SHADE SYSTEMS

System 1: Manual window shade, Fabric 1, regular roll direction, mounted for blackout with side and sill channels, chain operated control. Fabric to overlap opening as required to fit into surface mounted side and sill channel.

System 2: Manual window shade, Fabric 1, regular roll direction, mounted inside window frame, for blackout with side and sill channels, chain operated control.

## 2.04 FABRIC

- A. Fabric 1: Room Darkening.
  - 1. Basis of Design: Mechoshade, Classic Blackout 0700 Series:
    - a. Openness factor: Opaque
    - b. Color: Light Gray 0702

## 2.05 MANUALLY OPERATED WINDOW SHADE SYSTEM

- A. Products: Basis of Design
  - 1. Mechoshade; Mecho/5 System.
- B. Chain Operation: Bi-directional wrap spring clutch shall allow for shade to stop and hold at any position.
- C. Chain Operator Position: Right-hand side, unless otherwise noted on drawings.
- D. Bead Chain: No. 10 stainless steel.
- E. Clutch mechanism: Fabricated from high carbon steel.
  - 1. Components fabricated from styrene based plastics, polyester or reinforced polyester are not acceptable.

## 2.06 SHADE COMPONENTS

- A. Rollers:
  - 1. Shade roller tube shall be extruded aluminum of diameter and wall thickness required to support shade fabric. Maximum allowable deflection  $L/700$ .
  - 2. Rollers shall be easy to remove from support brackets.
- B. Mounting Brackets: Stamped steel, custom fabricated as required for mounting style indicated.
- C. Hembar: Concealed.

## 2.07 ACCESSORIES

- A. Finish for accessories, unless otherwise noted: White baked enamel.
- B. Fascia: Provide L-shaped extruded aluminum fascia to conceal mounting hardware, roller tube, and fabric rolled on tube for shades mounted between the jambs.
- C. Pocket: Provide Extruded aluminum surface mounted pocket which shall conceal mounting hardware, roller tube, and fabric rolled on tube for surface mounted shades.
- D. Fascia/Pocket End Caps: Provide end caps where mounting conditions expose outside of roller shade brackets.
- E. Fascia/Pocket Bottom Closure: Provide 3 inch extruded aluminum fascia/pocket bottom closure which shall conceal mounting hardware, roller tube, and fabric rolled on tube when viewed from below.
- F. Blackout side and sill channels.
  - 1. Single-Side Channel with guides at non-shared end jambs.
  - 2. Double-Side Channel with guides at shared jambs between shades.
- G. Light Seal Hem Bar: Provide Light-Seal Hem Bar

## 2.08 SHADE FABRICATION

- A. Shades mounted inside window frame: Window shade system shall completely fill opening from head to sill. Provide 1/4 inch clearance between each side of the shade and jamb, unless indicated otherwise.
- B. Shades mounted for room blackout: Window shade system shall completely fill opening from head to sill. Refer to manufacturer's specifications for side and sill channels.
- C. Shade fabric shall hang flat without buckling or distortion and in the same direction.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Field verify opening sizes and mounting prior to starting work.
- B. Do not begin installation until substrates have been properly prepared.
- C. Correct unsatisfactory substrates before proceeding.

### 3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Verify that blocking and framing necessary to carry shade assembly hardware is properly installed and secure.

### 3.03 INSTALLATION

- A. Install window shade systems level, plumb, square and true according to manufacturer's written instructions and these specifications.
- B. Adjust and balance roller shades to operate smoothly, safely and free from binding or malfunction throughout entire operational range.
- C. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
- D. Installer to train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.

### 3.04 PROTECTION

- A. Protect installed products until completion of project.

### 3.05 ROOM SCHEDULE

- A. System 1; Between the Jamb Mount: Room 153 South Wall
- B. System 2; Surface Mount: Room 153 West Wall

END OF SECTION



## SECTION 12 35 53 - LABORATORY CASEWORK

### PART 1 GENERAL

#### 1.01 SUMMARY

- A. Section Includes
  - 1. Wood laboratory casework.
  - 2. Laboratory work surfaces.
  - 3. Laboratory sinks.
  - 4. Water and laboratory gas services fittings.
  - 5. General laboratory accessories.
  - 6. Free-standing safety storage cabinet.
  - 7. Heavy duty shelving

#### 1.02 REFERENCES

- A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.
- B. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.
- C. ASME A112.18.1 - Plumbing Supply Fittings; 2018.
- D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).
- F. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2016.
- G. NFPA 30 - Flammable and Combustible Liquids Code; 2018.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. 29 CFR 1910 - Occupational Safety and Health Standards; current edition.
- J. SEFA 10 - Adaptable Laboratory Furniture Systems; 2013.
- K. SEFA 2.3 - Installations; 2010.
- L. SEFA 7 - Laboratory Fixtures; 2010.
- M. SEFA 8M - Laboratory Grade Metal Casework; 2016.
- N. SEFA 8P - Laboratory Grade Polypropylene Casework; 2014.
- O. SEFA 8PL - Laboratory Grade Plastic Laminate Casework; 2016.
- P. SEFA 8W - Laboratory Grade Wood Casework; 2016.
- Q. UL (ECMD) - Electrical Construction Materials Directory; current edition.
- R. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

#### 1.03 DEFINITIONS

- A. Abbreviations:
  - 1. CFM:Cubic feet per minute.
  - 2. MDF:Medium-density fiber board.
  - 3. PSI:Pound per square inch.
- B. Broom clean: A condition in an interior area in which surface debris has been removed by dry methods.
- C. Service fittings and fixtures: Service fittings include gas, air, vacuum, and special gas valves including factory piped turrets when mounted on work surfaces; hot, cold, reagent grade water faucets; remote control valves for fume hoods; and vacuum breakers.

- D. Service lines: Conduit, junction boxes, conduit fittings, wire disconnect switches and fuse or circuit breakers necessary to carry electrical services from building roughing-in outlets in floors or walls through equipment to service fixtures.
- E. Rough-in point: Individual or common supply of mechanical, electrical, and heating, ventilating and air conditioning (HVAC) through wall, floor, or ceiling, generally located within the utility umbilical, equipment chase, or service space behind cabinets.
- F. Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than 48 inches above floor, tops of cabinets less than 72 inches above floor, and visible surfaces in open cabinets or behind glazed doors.
  - 1. Ends of cabinets visible when the full installation is completed, shall be considered exposed.
- G. Semi-exposed Surfaces of Casework: Surfaces behind opaque doors, such as interiors of cabinets, shelves, dividers, interiors and sides of drawers, and interiors faces of doors. Tops of cabinets 72 inches or more above floor, back panel in knee spaces, the three non-visible edges of adjustable shelves, holes and openings including notches at shelving and grommets shall be considered semi-exposed. Toe space shall be considered semi-exposed.
- H. Concealed Surfaces of Casework: Includes sleepers, web frames, dust panels, and other surfaces not visible after installation.
  - 1. Ends of cabinets installed directly against and completely concealed by walls or other cabinets after installation shall be considered concealed.

#### 1.04 SUBMITTALS

- A. Submit all of the following on the same date. Submit complete, coordinated data. Partial submittals are not acceptable unless specifically approved by the Architect.
  - 1. Product data.
  - 2. Samples for initial selection.
  - 3. Shop drawings.
  - 4. All of the above for this section and for Section 11 53 13 - Laboratory Fume Hoods.
- B. Product Data: Provide manufacturer's data and installation instructions for each type of laboratory casework unit, service fixtures, and accessories.
  - 1. Certification by an independent testing laboratory indicating that applied finish complies with specified chemical and physical resistance requirements.
  - 2. Certification by an independent testing laboratory that the casework complies with the specified requirements.
- C. Samples for Initial Selection:
  - 1. Factory-applied finishes and other materials requiring color selection.
- D. Samples for Verification:
  - 1. Two of each type of casework material with each type of specified finish.
  - 2. Two of each type of work surface material with each type of specified finish.
  - 3. One mixing water fixture, one fumehood gas fixture, and one mounting type of each panel mounted fixture for each type of laboratory gas specified.
  - 4. Finished wood samples shall be submitted to establish acceptable range of color, grain characteristics and quality of wood veneers and finishes. Finish samples shall be furnished on same material as intended installation items.
  - 5. Acceptable samples will be used for comparison inspections at project. Retain acceptable sample units in building until completion of work and remove sample units from premises when directed by Architect.
- E. Shop Drawings: Large scale plans, elevations, cross sections, and details indicating layouts, dimensions, service run spaces, and attachment to other works.
  - 1. Indicate locations of hardware and keying of locks.
  - 2. Indicate locations and type of service fittings.
  - 3. Indicate locations of blocking and reinforcements required for installing casework.
  - 4. Include details of utility spaces showing supports for conduits and pipings.

5. Include details of support framing system.
  6. Include coordinated dimensions for laboratory fume hoods specified in other Sections.
- F. Contract Closeout Submittals:
1. Project Record Documents:
    - a. Provide 1 set of record documents including plans, elevations, cross sections, and details indicating layouts, dimensions, service run spaces, and locations and types of service fixtures.
    - b. Marked up shop drawings and documents will not be acceptable.
  2. Cleaning Data: Manufacturer's instructions for cleaning casework finishes and work surfaces
  3. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### 1.05 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide laboratory casework with tops, sinks, service fixtures, and accessories, manufactured or furnished by a single laboratory casework company.
- B. Integrate fume hoods specified in Section 11 53 13 with casework as shown on drawings.
- C. Installer Qualifications: Company specializing in performing the work of this section with minimum five years experience.
- D. Products Requiring Electrical Connection: Listed and classified by UL (ECMD) as suitable for the purpose specified and indicated.
- E. PRE-INSTALLATION MEETING
  1. Convene 1 month before starting work of this section.

#### 1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Storage:
  1. If installation cannot commence in a timely manner after delivery, casework and equipment may be placed in storage. Additional costs for handling, shipping, and storage shall be borne by the Contractor.
  2. In the case of items, such as service fittings, that may be shipped to the job site on larger projects and used over the course of several months installation, provide a secure, locked storage area for use to safeguard this equipment at the job site prior to installation.
- B. Protection:
  1. Protect finished surfaces from soiling and damage during delivery, storage, and handling. Cover with polyethylene film or other protective covering.
  2. Laboratory casework and counters are not to be used as workbenches, work platforms, and scaffolding for any portion of the work by any trade. Furniture and casework, as installed, is considered to be finished equipment and shall be protected from damage by all trades.
  3. The Contractor shall protect installed laboratory casework and equipment, especially the laboratory work surface, from debris, paint, and damage in the course of the construction sequence.

#### 1.07 PROJECT CONDITIONS

- A. Environmental Requirements:
  1. Interior spaces where casework, service fittings, and accessories are to be installed shall be conditioned to final design temperature and humidity level for minimum 24 hours prior to and continuously after installation, and in accordance with SEFA 2.3.
  2. Do not deliver or install casework, tops, service fittings, and accessories until the following conditions have been met:
    - a. Windows and doors are installed and the building is permanently closed in and weathertight.
    - b. Ceiling, overhead ductwork and lighting are installed.
    - c. All painting is completed and floor tile is installed.



## 1.08 SEQUENCING

### A. Casework:

1. Base cabinets:
  - a. On Resilient Flooring:
    - 1) Flooring with integral cove base: Install base cabinets after installation of finish flooring and cove.
    - 2) Flooring without integral cove base: Install base cabinets after installation of finish flooring, before rubber base.
2. Base and wall cabinets:
  - a. Painted walls: Install cabinets after last coat of paint.

## 1.09 WARRANTY

- A. Wood Casework: Provide written warranty signed by the manufacturer guaranteeing to correct failures in products which occur within one year commencing on the Date of Substantial Completion, without reducing or otherwise limiting any other rights to correction which the Owner may have under the Contract Documents. Correction may include repair or replacement.
- B. Solid Polymer Work Surface: Provide written 10 year warranty against defects in materials. Warranty shall provide material and labor to repair or replace defective materials. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.
- C. Warranties shall commence on Date of Substantial Completion.

## PART 2 PRODUCTS

### 2.01 SUBSTITUTIONS

- A. Refer to Section 01 60 00 - Product Requirements.

### 2.02 MANUFACTURERS

- A. Source Limitations: Provide laboratory casework through the same source from a single manufacturer.
- B. Obtain laboratory casework through the same source from the same manufacturer as laboratory fume hoods specified in Section 11 53 13 - Laboratory Fume Hoods.
- C. Wood Casework:
  1. Kewaunee Scientific Corporation; Statesville, NC, 704-873-7202: [www.kewaunee.com](http://www.kewaunee.com).
  2. Bedcolab; Laval Quebec, Canada, 800-461-6414: [www.bedcolab.com](http://www.bedcolab.com).
  3. Mott Manufacturing Ltd, Brantford, ON, Canada, 519-752-2895: [www.mott.ca](http://www.mott.ca).
  4. CiF Lab Casework Solutions; Concord, ON, Canada, 905-738-5821: [www.cifsolutions.com](http://www.cifsolutions.com)
- D. Fixtures and Accessories:
  1. As listed by individual items below.

### 2.03 PERFORMANCE REQUIREMENTS

- A. Casework and Adjustable Shelving:
  1. Loading Requirements: Casework components shall withstand the following minimum loads without damage to the component or to the casework operation when tested in accordance with SEFA 8M, SEFA 8P, SEFA 8PL, SEFA 8W, and SEFA 10.
    - a. Base unit load capacity:
      - 1) 200 lb per square foot of cabinet top area.
      - 2) Leveling bolts: 500 lb each; minimum one per corner of each base cabinet.
    - b. Drawers in a cabinet: 150 lb uniform load with smooth operation for minimum 10,000 cycles of opening and closing.
    - c. Tables, 4 legged: 300 lb.
    - d. Hanging wall cases: 300 lb.
    - e. Shelves:

- 1) Shelves inside base cabinets, wall and tall cabinets: 100 lb.
- 2) 40 lb/sf up to a maximum of 200 lb with nominal temporary deflection, but without permanent set.
2. Chemical Resistance Requirements: Test the exterior finish of laboratory casework and adjustable shelving for resistance to chemical reagents in accordance with SEFA 8, and meets Level 1 rating - slight change in color or gloss, and with no loss of adhesion and no loss of film protection.
  - a. Moisture Resistance: No visible effect when finish surface exposed to the following:
    - 1) Tested in accordance with SEFA 8.
    - 2) Constant Moisture using a 2 inch x 3 inch x 1 inch cellulose sponge, soaked with water, in contact with surface for 100 hours.
  - b. Cold Crack: No effect when subjected to 10 cycles of temperature change from 20 degrees F for 60 minutes to 125 degrees F for 60 minutes.
    - 1) Adhesion: Tested in accordance with SEFA 8; ninety or more squares of the test sample shall remain coated after the scratch adhesion test.
    - 2) Flexibility: No peeling or cracking or exposure of metal when metal is bent 180 degrees over a 1/2 inch diameter mandrel.
  - c. Hardness: Tested in accordance with SEFA 8 for surface hardness equivalent to 4H or 5H pencil.
  - d. Abrasion resistance: Maximum weight loss of 5.5 mg. per 100 cycle when tested on a Taber Abrasion Tester #E40101 with 1000 gm wheel pressure and Calibrase #CS10 wheel.
  - e. Humidity resistance: Withstand 1000 hour exposure in saturated humidity at 100 degrees F.
  - f. Salt spray: Withstand minimum 200 hour salt spray test.

#### 2.04 PRODUCT OUTLINE

- A. Numbering system indicated in the casework drawings legend are provided to indicate casework size, and configuration.
- B. Wood Cabinets:
  1. Species: Refer to Materials Section.
  2. Cabinet Construction and Door Style AWI/AWMAC/WI (AWS): Flush overlay with square edge door.
  3. Grain Direction:
    - a. Door fronts and exposed sides of individual cabinets: Vertical.
    - b. Drawer fronts:
      - 1) Vertical.
    - c. Shelving: Horizontal.
  4. Grain Pattern:
    - a. Matching Between Adjacent Veneer Leaves:
      - 1) Slip Match.
    - b. Matching within Individual Panel Faces:
      - 1) Balance and Center Match.
    - c. Across drawer fronts, doors and fixed panels per Cabinet: Architectural End Match.
      - 1) Exception: When a single drawer front aligns over a pair of doors.
    - d. Adjacent cabinets are not required to be grain matched, however, similar grain patterns, color shades and tones are required.
  5. Finish: Clear, complying with SEFA 8.
- C. Modular Movable Bench System:
  1. Product:
    - a. Bedcolab Symphony II System.
    - b. CiF Ascent Flexible Tables.
    - c. Kewaunee Enterprise Adaptable Movable Workstation.
    - d. Mott Optima Laboratory Bench System.

2. Material:
  - a. Bench System: Cold rolled sheet steel.
  - b. Shelving: Wood. Refer to Materials Section.
3. Design, Color and Finish:
  - a. Bench System:
    - 1) Finish: Powder coated, complying with SEFA 8.
    - 2) Color: White.
  - b. Shelving color and finish:
    - 1) Clear, complying with SEFA 8.

## 2.05 MATERIALS

- A. Hardwood Plywood: Comply with requirements of HPVA HP-1 or AWI/AWMAC/WI (AWS) Section 200.
  1. Face Species:
    - a. Exposed:
      - 1) Select White Maple, plain sliced.
    - b. Semi-Exposed:
      - 1) Select White Maple, rotary cut.
    - c. Concealed: Manufacturer's option.
  2. Grade:
    - a. Exposed: Grade A faces and Grade J crossbands.
    - b. Semi-Exposed: Grade C faces and Grade J crossbands.
    - c. Concealed: Manufacturer's option.
  3. Core:
    - a. Veneer: Multi-ply veneer core, with cross and face plies bonded with Type II water resistant glue. Combo core is not acceptable.
    - b. Medium Density Fiberboard (MDF): 3-ply, ANSI A208.2 grade 130-MR50, 45-50 lb density, MDF core with veneer face and back.
    - c. Particleboard: 3-ply, ANSI A208.1 grade M-3, 40-45 lb density, particleboard core with veneer face and back.
    - d. Combination: Veneer core with particleboard cross bands, veneer face and back.
    - e. Formaldehyde Free Medium Density Fiberboard (MDF): ANSI A208.2; composed of wood fibers pressure bonded with moisture resistant adhesive with no added formaldehyde, to suit application; sanded faces; thickness as required.
    - f. Use of softwoods such as Fir and Pine is not permitted.
  4. Edgebanding: 1/8 inch hardwood of same species as exposed face veneers.
- B. Solid Lumber:
  1. Species:
    - a. Exposed:
      - 1) Select White Maple.
    - b. Semi-Exposed:
      - 1) Select White Maple.
    - c. Concealed: Suitable for intended purpose.
  2. Grade:
    - a. Exposed: Grade I, kiln dried to maximum 6 percent uniform moisture content.
    - b. Semi-Exposed: Grade II, selected to eliminate appearance defects, Kiln dried to 7 percent.
    - c. Concealed: Grade III, Kiln dried to 7 and 12 percent
- C. Glass: ASTM C1048, fully tempered using horizontal tempering; exposed edges ground, and cut or drilled to receive hardware.
  1. Framed doors: 1/8 inch thick glass.
  2. Unframed sliding glass doors: 1/4 inch thick glass.
- D. Sealant: mildew-resistant silicone, specified in Section 07 92 00.

2.06 CASEWORK HARDWARE:

- A. Drawer and Hinged Door Pulls: 4 inch wire pull type, surface mounted with through-bolt from back, Stainless steel, No. 4 finish. Provide 2 pulls for drawers over 24 inches in width. Pull shall meet State and Federal Handicapped Accessibility Regulations.
- B. Sliding Door Pulls: Flush design with recessed finger grip; satin finish chrome plated.
- C. Hinges:
  - 1. Institutional type five knuckle, minimum 2-1/2 inch long, wrap around design.
  - 2. Finish: Stainless steel, No. 4.
  - 3. Provide two hinges for doors up to 36 inches; three hinges for doors over 36 inches high.
- D. Roller catches: Adjustable type, spring actuated polyethylene roller and steel strike plates.
- E. Elbow catches: Spring type of cast aluminum with bronze finish, with strike.
- F. Drawer Slides:
  - 1. Manufacturers:
    - a. Basis of Design: Accuride International, Inc.
    - b. Hafele America Co.
    - c. Knappe & Vogt Manufacturing Company.
  - 2. Light/Medium Duty Drawer Slides For Drawers 24 inches Wide or Less: Accuride 7434 with overtravel.
    - a. Overtravel: 1 inch.
    - b. Type: All ball bearing, full extension, rail-mounted, hold-in detent, smooth progressive movement.
    - c. Capacity: 100 pounds per pair for 18-inch slide length.
    - d. Finish: Clear zinc.
  - 3. Heavy Duty Drawer Slides For Drawers 48 inches Wide or Less and Standard File Drawers: Accuride 3640.
    - a. Type: All ball bearing, full extension, rail/bracket-mounted, hold-in detent, smooth progressive movement with 1 inch overtravel.
    - b. Capacity: 200 pounds per pair for 18-inch slide length.
    - c. Finish: Clear zinc.
  - 4. The drawer shall be removable without the use of tools and yet prevent inadvertent drawer removal.
- G. Locks: Heavy duty cylinder type. Exposed lock noses shall be dull nickel, satin plated, and stamped with identifying numbers.
  - 1. Disk Tumbler: Locks shall have capacity for 225 primary key changes. Master key one level with the potential of 40 different, non-interchangeable master key groups.
  - 2. Pin Tumbler: Locks shall have capacity for 1000 primary key changes, and the capacity to be masterkeyed, grand-masterkeyed, sub-masterkeyed and mason keyed.
  - 3. Keys: Stamped brass available from manufacturer or local locksmith, and supplied in the following quantities unless otherwise specified:
    - a. Two for each keyed different lock.
    - b. Three for each group keyed alike locks.
    - c. Two for master keys for each system.
- H. Shelf clips: Twin pin type for mounting on interior of cabinet end panels. Clips shall be corrosion resistant and shall retain shelves from accidental removal. Shelves shall be adjustable on 32 mm centers.
- I. Leg shoes shall be provided on all table legs, unless otherwise specified, to conceal leveling device. Shoes shall be 2-1/2 inch high and a pliable, black vinyl material.
- J. Floor glides, where specified for movable open-leg tables, shall be a non-marring material at least 1 inch dia. to prevent indenting composition flooring and shall have at least a 5/8 inch height adjustment. Use of metal buttons will not be acceptable.

- K. Base Molding: Provided by others at all fixed casework locations unless noted otherwise on Drawings.

2.07 MODULAR FIXED BASE AND WALL CABINETS - (WOOD).

- A. Cabinets shall comply with AWI/AWMAC/WI (AWS) Section 1600.

B. General requirements:

1. For flush overlay style cabinet:
  - a. Door and drawer design: Square edge flush. Door and drawer, when closed shall rest against face of cabinet shell.
  - b. Apron: Flush with doors and drawers.
    - 1) Provide applied panel at sink base.
2. For inset style cabinet:
  - a. Door and drawer design: Square edge flush. Door and drawer, when closed, shall be recessed flush with face of cabinet shell.
3. Cabinets, 30 inches and wider, with double swinging doors shall provide full access to complete interior without center vertical post.
4. Filler strips: Provide as needed to close space between cabinets and walls, ceilings, and indicated equipments. Fabricate from the same material, color and finish as cabinets.

C. Construction:

1. End panels, bottoms, and shelves: 3/4 inch veneer core hardwood plywood with 1/8 inch banding on front edges.
  - a. End panels concealed in final assembly shall be of same species and finish as exposed end panels to permit future reconfiguration of cabinets.
2. Backs:
  - a. Exposed backs: 1/4 inch veneer core hardwood plywood.
  - b. Unexposed backs: 1/4 inch, tempered hardboard. Dado into end panels and bottoms. Securely fasten. Cleats are unacceptable.
3. Intermediate rails: 3-1/4 inch x 3/4 inch hardwood plywood with 3/4 inch x 1/8 inch facing on exposed edges. Dowel and glue to end panels. Mount at front between drawers and between drawers and doors.
4. Structural rails and box frames: Solid hardwood.
5. Drawers:
  - a. Sides, subhead and back: 1/2 inch thick hardwood plywood.
  - b. Fronts: 3/4 inch thick, MDF or Particleboard core hardwood plywood .
  - c. Bottoms: 1/4 inch thick tempered hardboard.
  - d. Drawer Construction:
    - 1) Attach head to sides with dovetail joint.
    - 2) Backs: Dovetail into sides.
    - 3) Bottoms: Set and glue into 1/4 inch grooves, four sides.
6. Doors:
  - a. Solid Doors: 3/4 inch thick, MDF or Particleboard core hardwood plywood .
  - b. Stile and Rail at Glazed Doors: Solid hardwood with mortise and tenon or doweled connections, glued and screwed.
7. Shelves:
  - a. Adjustable shelves in cabinet shall be full width and full depth.
  - b. Gap between front edge of shelf and closed cabinet door shall be less than 1 inch.
  - c. Shelves shall be adjustable on 1-1/4 inch (32 mm) centers using shelf support clips.

2.08 MODULAR FIXED BASE AND WALL MOUNTED CABINETS - (METAL).

A. General Requirements:

1. For flush overlay style cabinet:
  - a. Door and drawer design: Square edge flush. Door and drawer, when closed, shall rest against face of cabinet shell.
  - b. Apron: Flush with doors and drawers.

- 1) Provide applied panel at sink base.
2. For flush inset style cabinet:
  - a. Door and drawer design: Square edge flush. Door and drawer, when closed, shall be recessed flush with face of cabinet shell.
- B. Base Cabinet:
  1. Cabinet Bottom and Bottom rail:
    - a. Formed of one piece of steel.
    - b. Formed down on side and back to create square edge transition welded to cabinet end panels.
  2. Back: Cupboard unit only shall be provided with removable back panel.
- C. Wall Cabinet- Up to 36 inches high:
  1. End Panels and Backs: Formed of one piece wrap around design with internal reinforcing front and rear posts.
  2. Tops and Bottoms: One piece with front edge formed into front rail.
  3. Doors:
    - a. Solid panel doors: 3/4 inch thick, double wall, box construction, structurally rigid. Assembled with interior sound deadening.
    - b. Frame glazed doors:
      - 1) One piece welded, exterior and interior head frame. Interior head frame to be removable for installation and replacement of glass.
      - 2) Provide vinyl glazing retainer to receive glass.
      - 3) All other aspects of framed glazed door construction and quality shall match solid panel door.
    - c. Hinged doors shall close against rubber bumpers.

#### 2.09 ACID STORAGE CABINETS - WOOD

- A. One piece corrosion resistant interior liner, including the backside of doors and shelf surfaces.
- B. One-piece corrosion resistant insert tray with 2 inch lip for containment of spills at bottom of cabinet.
- C. One shelf with 1 inch lip, adjustable on 1 inch increments.
- D. Vented with a minimum 1-1/2 inch I.D. corrosion resistant vent pipe at rear of cabinet terminating inside of fume hood 2 inch above the working surface, color to match work surface.
- E. Vent pipe shall be close to rear of hood as possible. Seal opening between working surface and pipe with chemical resistant material.
- F. Exhaust ports shall have fire screens.
- G. Non-metal door catch or strike plate.
- H. Front of cabinet labeled with minimum 1 inch high, 1/4 inch stroke red letters: "ACID".
- I. Color and Finish: Match wood base cabinets.
- J. Design: Match wood base cabinets.

#### 2.10 FLAMMABLE LIQUIDS STORAGE CABINETS - WOOD

- A. Identified for flammable and combustible liquids shall be constructed in compliance with UL, OSHA, NFPA Standard No. 30, and UFC Article 79.
- B. Self closing and self latching doors synchronized so that both doors will always fully close.
- C. Bottom of the cabinet liquid tight to a height of 2 inches.
- D. Cabinet shall not have vent outlet.
- E. Front of cabinet labeled with minimum 1 inch high, 1/4 inch stroke red letters: "FLAMMABLE - KEEP FIRE AWAY".
- F. Color and Finish: Match wood base cabinets.
- G. Design: Match wood base cabinets.

### 2.11 MODULAR MOBILE BASE CABINET WITH ADD-A-DRAWER - (WOOD)

- A. Performance Requirements: Same as fixed cabinet described above.
- B. Construction Type: Same as fixed cabinet.
- C. Construction:
  - 1. Fabricated in two sections with a removable top drawer unit, over bottom single door cupboard unit or a three drawer unit.
  - 2. Nominal 22 inches front to back.
  - 3. End panels, back and bottom: Same construction as fixed wood base cabinet.
  - 4. Top panel of cupboard unit and top panel of "Add-a-Drawer" unit shall have high pressure, chemical resistant plastic laminate finish. Color to match work surface.
  - 5. Bottom unit of mobile cabinets shall be constructed with reinforced base capable of supporting a 4 inch (102 mm) high caster assembly in each corner.
  - 6. Casters: Swivel locking type, rated for minimum 253 lb (115kg) load each.
  - 7. Entire assembly shall be reinforced to permit mobility without twisting and achieve an industry standard height of 30 inches (762 mm) or 36 inches (914 mm), not including the 1 inch (25.4 mm) counter top.
  - 8. Allow sufficient clearance between top of cabinet and underside of countertop or apron to facilitate movement.
  - 9. Equip each cabinet with anti-tipping counter weight.

### 2.12 VERTICAL UTILITY CHASE ENCLOSURE.

- A. Closure panel material for wood casework:
  - 1. Material: Wood to match adjacent casework species and grain.
  - 2. Color and Finishes: Match adjacent casework color and finishes..
- B. Closure panel material for metal casework:
  - 1. Material: Painted metal to match adjacent casework.
- C. Construction:
  - 1. Provide removable sections as indicated.
  - 2. Extend from floor or top of work surface to not less than 6 inch above ceiling.
  - 3. Fasteners: Concealed.
- D. Collars:
  - 1. Provide collar at ceiling.
  - 2. Material: 16 gauge painted steel.
- E. Supports: Steel channel or tube shape fastened to floor or counter top and building structure above.

### 2.13 ADJUSTABLE SHELVES

- A. Wood Shelves:
  - 1. Species: Match wood casework.
  - 2. Hardwood plywood with grade A veneer finish on top and bottom faces.
  - 3. Thickness:
    - a. Less than 48 inch length: 3/4 inch.
    - b. 48 inches and greater: 1 inch.
  - 4. Front Edge and Exposed Ends: Faced with 1/8 inch solid hardwood to match plywood veneer.
  - 5. At Rear: Provide 3/4 inch thick hardwood edge band to create minimum 1 inch high curb at rear of shelf in lieu of back edge banding.
  - 6. Finish: Match casework finish.
- B. Shelf Depth: Provide 12 inch, 18 inch, and 24 inch shelf depths where indicated.
- C. Shelf Lengths: Shall be available in 6 inch increments to 72 inch length. Match the length of the structural module.
- D. Support System for Adjustable Shelves:

1. Wall mounted shelf support: Double-slotted standards.
  2. Counter top mounted shelf support: Tubular shape with slotted holes.
  3. Adjustable height: Adjustable on 1 inch increments.
  4. It shall be the responsibility of the casework manufacturer to provide a guideline for the location of wall blocking to Contractor prior to the installation of the casework.
- E. Brackets: Book end type; stainless steel; 11 gauge; mount to inner slot of double slotted support module upright.
1. Fasten shelves to brackets with two stainless steel screws per bracket.

#### 2.14 MODULAR MOVABLE BENCH SYSTEM

- A. Products:
1. CiF Ascent Flexible Tables.
  2. Bedcolab Symphony Bench System.
  3. Kewaunee Enterprise Adaptable Movable Workstation.
  4. Mott Optima Laboratory Bench System.
- B. Construction:
1. Double Sided Work Surface Support Frame and Rear Work Surface Support Frame.
  2. Single Sided Work Surface Support Frame and Rear Work Surface Support Frame.
  3. Rear support frame shall incorporate vertical post and horizontal support. The vertical supports shall incorporate individual slots for adjustable shelving. The vertical supports shall also incorporate a chase for pre-plumbing and/or pre-wiring of services.
- C. Rails and Stretchers: Provide sides and back rail as required. No stretcher rail.
- D. Work Surface Support Frames:
1. Construction: Welded four sided assembly consisting of 11 gauge steel channel formations, and rear attachment collars. Nominal lengths as indicated on Drawings.
  2. Adjustable in height from 30 inches to 36 inches inclusive of 1 inch table top. Install with work surface 36 inches above finished floor unless noted otherwise.
  3. Adjustable portion of legs shall be stainless steel, drilled at 2 inch increments. Provide 1 stainless steel pin insert with chain at each leg.
  4. Legs shall include 3/8 inch diameter levelers.
  5. Collars: Rear corners shall have 2.25 inch diameter x 6 inch high 11 gauge collars or equivalent reinforcing structure. The front half of the collar shall be welded to the work surface frame with supporting gussets and the back half mechanically fastened to the rear upright supports with socket head button cap and bolt.
  6. A full length horizontal back stop bumper shall be located under the work surface frame to position mobile base cabinets 1 inch behind the front edge of the work surface.
- E. Rear Workstation Support Frames:
1. Rear frame support structure shall be 84 inches in height, in the same nominal length as the work surface support frame.
  2. Rear frame support structure:
    - a. Single sided: Support structures shall consist of a 2 inch x 2 inch vertical member, with horizontal framing members. The vertical member shall incorporate removable closure panels for access to service fittings, and include 3/8 inch levelers and receiver box for electrical or telecommunications device outlet.
    - b. Double sided: Support structures shall consist of a 2 inch x 6 inch vertical member, with horizontal framing members. The vertical member shall incorporate removable closure panels for access to service fittings, and include 3/8 inch levelers and receiver box for electrical or telecommunications device outlet.
  3. All rear frame support structures in widths over 48 inches wide shall have a center support to accommodate split shelving.
  4. The vertical members shall have slots punched on 1 inch increments starting at 55 inch AFF to top of upright for adjustable shelves.



5. The vertical members shall have slots punched on 2 inch increments to accommodate the adjustable in height work surface from 30 inches to 36 inches, inclusive of 1 inch table top.
6. Rear frame support structures shall incorporate upper and intermediate horizontal cross rails. The upper cross rail shall provide a utility trough the full length of the table. The intermediate cross rail shall support an integral two channel raceway with removable access panels.
  - a. Utility channel in upper cross rail shall be used to consolidate all utility connections to a single side of the frame. Designs requiring utility connections at both sides of the rear frame are not acceptable.
7. Tops: 1 inch thick resin to match work surfaces.
8. Shelving:
  - a. Wood: Match wood casework.
  - b. Finish: Match casework finish.
  - c. Hardwood plywood with grade A veneer finish on top and bottom faces.
  - d. Thickness: 3/4 inch.
  - e. Front Edge and Exposed Ends: Faced with 1/8 inch solid hardwood to match plywood veneer.
  - f. Shelf retaining lip:
    - 1) 16 gauge powder coated steel, color to match bench system.
    - 2) Mount at rear of all shelves.
  - g. Shelf retaining rod:
    - 1) 3/8 inch diameter powder coated steel, color to match bench system.
    - 2) Mount at front of bottom and middle shelves.
  - h. Shelving brackets: Angled type. Powder coated steel.
    - 1) 16 gauge as required for configuration shown on drawings. Powder coated.
9. Plumbing Service Tubes: Factory installed, designed to convey services from inlet at top of leg to outlet of factory installed service fixture connection in the leg wall below. Hoses to include keyed quick connect fittings.
  - a. Air, Vacuum and other Non-burning Gases: Reinforced PVC.
  - b. Natural and Reactive Gases: Stainless Steel.
10. Electrical Services: Factory installed and pre-wired. UL labeled.
  - a. Number of Circuits:
    - 1) Single Sided Bench System: Single Circuit
      - (a) Refer to Laboratory details for receptacle/circuit identification.
    - 2) Double Sided Bench System: 2-qty Single Circuit
      - (a) Refer to Laboratory details for receptacle/circuit identification.
  - b. Leg Mounted Outlet: 120 V, 20 Amp Duplex outlet. Cover plate color matched urethane powder coated steel to match casework.
  - c. Horizontal Power Bar:
    - 1) Power:
      - (a) For bench units 48 inches in length:, (4) total 120 V, 20 Amp Duplex outlets, (2) on each side of the power bar.
      - (b) Front Bar: (2) 120 V, 20 Amp duplex outlets
      - (c) For bench units 60-72 inches in length: (8) total 120 V, 20 Amp Duplex outlets, (4) on each side of the power bar.
    - 2) Telecommunications: (2) outlet, RJ-45 type. Category 6 cabling; coordinate with wiring installer to provide appropriate cabling and terminations.
    - 3) Finish: Match casework finish.
  - d. Pre-Wired Power Cord: Provided for connection of power from the top of the support frame to the ceiling service panel or vertical utility chase.
    - 1) Single Sided Bench System:
      - (a) Single circuit, 3 wire power cord.
      - (b) 60 inch length extension from rear support frame.
      - (c) NEMA L5-20P twist-lock plug.

- 2) Double Sided Bench System:
    - (a) 2-qty Single circuit, 3 wire power cords.
    - (b) 60 inch length extension from rear support frame.
    - (c) NEMA L5-20P twist-lock plug.
  - 3) Color: White cord and white plug.
  - e. Provide wiring diagram in submittal for architect approval.
- F. Connection Brackets: Benches shall be furnished and installed with manufacturer's powder coated steel connection brackets/clamps to connect each adjacent (to back and to side) bench in an island or peninsula grouping so as to create a single fixed assembly. Surface of brackets in contact with bench frame shall be cushioned/non-marring, and brackets shall be readily removable and reusable using standard tools.
- G. Accessories:
1. Task Lights: Refer to Task Light in casework Accessories below.
  2. Plumbing Service Lines: Provided for connection of services from the top of rear support frame to the ceiling service panel or adjacent vertical utility chase. Coordinate length of lines as required per bench and ceiling service panel locations shown on drawings (architect to approve length prior to installation - should not have more length than required to reach ceiling service panel). Service lines to include keyed quick connect fittings.
    - a. Air, Vacuum and other Non-burning Gases: Reinforced PVC hose.
    - b. Natural and Reactive Gases: Braided stainless steel hose.
    - c. Water: Reinforced PVC hose.
    - d. Length:
      - 1) At movable bench system to ceiling service panel locations: 60 inch length.
      - 2) At movable bench system to vertical utility chase locations: 36 in length.
    - e. Hoses to include keyed quick connect fittings.
    - f. Provide an additional 10 drop cords for building to be used in future as needed if benches are removed.
  3. Power Cord and Plumbing Service Line Management: Provide a removable flexible plastic shroud/wrap with hook and loop closure.
    - a. Basis of Design: Techflex, Flexo Wrap, color white.
  4. Telecommunications Service Lines: Provided for connection of services from the top of rear support frame to the ceiling service panel. Coordinate length of lines as required per bench and ceiling service panel locations shown on drawings (architect to approve length prior to installation - should not have more length than required to reach ceiling service panel).
    - a. Length: At movable bench system to ceiling service panel locations: 60 inch length.
    - b. Color: White.
- H. Design Loads: Per SEFA 8 and SEFA 10, with a minimum of 600 lb rating for a 72 inch x 30 inch at 36 inch high movable table.

## 2.15 FREE STANDING, ADJUSTABLE HEIGHT TABLES- METAL

- A. Material:
1. Tops: Refer to drawings for locations
    - a. 1 inch thick cast epoxy resin to match epoxy resin work surfaces.
    - b. Wood Work Surface
  2. Aprons, legs and rails: Steel to match metal casework.
- B. Table Frames:
1. Front Apron: 2 inches high.
  2. Side and Back: Manufacturer's standard.
- C. Rails and Stretchers: Provide sides and back rail as required. No stretcher rail.
- D. Legs: 2 inch by 2 inch steel tube with stainless steel telescoping leg insert.

1. Leg corner bracket: Welded construction with bolted attachment of leg to apron.
- E. Adjustable at height from 31 inches to 38 inches inclusive of 1 inch table top.
- F. Adjustable portion of legs shall be stainless steel, drilled at 1 inch increments. Provide 1 stainless steel pin insert with chain at each leg.
- G. Design Loads: Per SEFA 8M, with a minimum of 600 lb rating for a 72 inch x 30 inch at 36 inch high movable freestanding table.

## 2.16 WORK SURFACES

### A. General:

1. Fabricate components in shop to greatest extent practical to sizes and shapes indicated.
2. Provide holes and cutouts for service fixtures, service fittings, and service outlets.
3. Fabrication tolerances:
  - a. Size:
    - 1) Length: +/- 1/16 inch.
    - 2) Width: +/- 1/16 inch.
    - 3) Thickness: +/- 1/16 inch.
  - b. Cutouts:
    - 1) Sinks: +/- 1/8 inch.
    - 2) Cup sinks: +/- 1/8 inch.
    - 3) gem box: +/- 1/8 inch.
    - 4) Columns: + 1/8 inch, - 0 inch.
    - 5) Column cut-out, covered by applied curb: + 1/4 inch, - 0 inch.
    - 6) Service drilling: + 1/8 inch, - 0 inch.

### B. Epoxy Resin Work Surface:

1. Manufacturers:
  - a. Durcon Laboratory Tops, Inc.; Taylor, TX, 512-595-8000: [www.labtops.com](http://www.labtops.com).
  - b. Epoxyn LLC; Mountain Home, AR. 870-425-4321. [www.epoxyn.com](http://www.epoxyn.com).
  - c. Kewaunee Scientific Corp.; Stateville, NC. 704-873-7202. [www.kewaunee.com](http://www.kewaunee.com).
2. Material: Chemical and abrasion resistant, cast epoxy resins and inert products.
3. Thickness: 1 inch.
4. Color: Black.
5. Finish: Matte.
6. Back and Side Splash: Same material as top.
  - a. Height: 4 inches (102 mm).
  - b. Fabrication: Butt jointed and cemented to work surface.
  - c. Location: Where work surfaces abut walls. Include end curb where required.
7. Edges: See work surface type on Laboratory Casework drawing.

### C. Wood Work Surface:

1. Materials: Solid, kiln dried hardwood strips, 3 inch maximum width.
2. Fabrication: Build up hardwood strips; glue under heavy pressure in an electronic press with heat treated, water resistant resin glue. Stagger end joints 12 inches minimum.
3. Edges and corners: Round to 3/16 inch radius.
4. Thickness: 1-1/4 inch.
5. Finish: Natural color, moisture and reagent resistant varnish, stain finish.
  - a. Exposed surfaces: Three coats.
  - b. Unexposed surfaces: Two coats.

## 2.17 LABORATORY SINKS AND CUP SINKS

### A. General:

1. Sizes: See sink schedule on Laboratory Casework drawing.
2. Provide overflow, strainer and tailpiece with sink.

### B. Cast Epoxy Resin Sinks:

1. Manufacturers: Same as epoxy resin surface.

2. Molded in one piece with smooth surfaces, coved corners, and bottom sloped to drain.
  3. Material: Same as cast epoxy resin work surface.
  4. Mounting: Drop-in.
- C. Stainless Steel Sinks:
1. Material: 18 gauge, stainless steel, Type 302/304; No. 4 satin finish.
  2. Fabrication:
    - a. Standard stock sized sinks: Deep drawn from a single sheet.
    - b. Custom sized sinks: Continuous heliarc welded joints ground and polished smooth.
    - c. Corners: Rounded and coved, horizontal and vertical corners; minimum 5/8 inch radius.
    - d. Sink partitions: Double wall construction. Round top edge to minimum 1/2 inch diameter.
    - e. Continuous butt weld joints.
    - f. Factory punch for fittings.
    - g. Sound Deadening: 1/8 inch thick heat resistant material to prevent condensation and deaden sound. Do not apply to exposed surface
- D. Integral stainless Steel Sink: Refer to Stainless Steel Work Surface above.
- E. Cup Sinks:
1. Material:
    - a. Cast epoxy resin to match work surface.
    - b. Stainless steel, welded and ground smooth.
    - c. Polypropylene.
  2. Size: 3 inch x 6 inch oval.
  3. Locations:
    - a. Work surface.
    - b. Fume hood work surface.
- F. Outlets and Tailpiece:
1. Inlet: 1/2 inch diameter.
  2. Tailpiece: Minimum 6 inch long with 1-1/2 inch NPT outlet.
  3. Accessory: Strainer.
  4. Material: Same material as sink.
- G. Overflows (not for cup sinks):
1. Size: 2 inches less than sink depth.
  2. Material: Polypropylene.
  3. Configuration: Open top design.
  4. Outlet: 2 inches below top of work surface.

## 2.18 LABORATORY SERVICE FITTINGS

- A. Manufacturers:
1. WaterSaver Faucet Company: [www.wsflab.com](http://www.wsflab.com).
  2. Broen Corporation: [www.broen.com](http://www.broen.com).
  3. Chicago Faucet Company: [www.chicagofaucets.com](http://www.chicagofaucets.com)
- B. General Requirements:
1. Provide fittings comply with SEFA 7.
  2. Provide fittings complete with washers, locknuts, wall flanges, deck flanges, escutcheons, and other installation accessories.
- C. Materials:
1. Water and Gas Fittings: Cast or forged red brass containing minimum 85 percent copper.
  2. Pure Water Fittings: Brass body with pure tin interior lining.
- D. Design and Finishes: Forged brass, 4-arm style handle; Finish: Polished chrome.
- E. Service Indexes Color and Identification Code: Per SEFA standard and as listed below:
1. Cold Water Color: Dark green, Code: CW

2. Hot Water Color: Red, Code: HW
3. Air (Compress air) Color: Orange, Code: Air
4. Gas (Burning) Color: Dark blue, Code: Gas
5. VacuumColor: Yellow, Code: Vac
6. Purified Water Color: White, Color: DW, DI

F. Fabrication:

1. Water Service Fittings (Faucets and valves):
  - a. Equipped with renewable compression valve unit or cartridge containing all working components subject to wear, including replaceable seat and integral volume control device.
  - b. Capable of being converted from compression to self-closing type.
  - c. Gooseneck: Separate brazed coupling outlet for attachment of aerator, serrated hose end and other outlet fittings.
  - d. Vacuum Breaker:
    - 1) Where required and indicated, shall be integral with gooseneck.
    - 2) Equipped with renewable seat and valve designed for fine flow control.
  - e. Meet requirements of ASME A112.18.1.
2. Pure Water Service Fittings:
3. Dry Service Fittings (Air, Gas, Vacuum and Special Gas):
  - a. Needle Control Valves:
    - 1) Valve: Shall have stainless steel or monel metal renewable, self-centering, floating cone and replaceable seat.
    - 2) Body: Shall have removable serrated hose end.
  - b. Ball Valves:
    - 1) Valve: Chrome plated ball and PTFE seals.
    - 2) Handle: Black nylon, lever type with colored service index button.
  - c. Ground-Key-Type Hose Cocks:
    - 1) Valves: Tapered plug design, held in place under constant spring pressure.
    - 2) Handle: Forged brass, tapered lever type with colored service index button.

G. Service Fittings Schedule:

1. HCW-1: Hot/Cold Water Mixing Faucet, Deck Mounted.
  - a. Features: 6 inch spread, rigid/swing gooseneck, vacuum breaker; .
  - b. Model: WaterSaver CT4414VB-55-BH.
2. HCW-2: Hot/Cold Water Mixing Faucet, Panel Mounted.
  - a. Features: 6 inch spread, rigid/swing gooseneck, vacuum breaker; ; .
  - b. Model: WaterSaver CT1714VB-55-BH.
3. CW-1: Cold Water Faucet, Deck Mounted; Right Hand.
  - a. Features: 6 inch spread, rigid/swing gooseneck, vacuum breaker; Aerator; .
  - b. Model: WaterSaver CT3914VB-55.
4. EW-2: Dual Purpose Eye Wash/Drench Hose, 45 Degree Panel Mounted.
  - a. Features: 2 spray heads side by side. Squeeze handle with locking clip.
  - b. Model: Watersaver CTEW1041.
5. PR-1: Hot and Cold Water Pre-rinse Unit, Deck Mounted.
  - a. Features: Flexible stainless steel hose, valve hook, self-closing valve with handle and locking ring, rubber-bound spray-type outlet head.
  - b. Model: WaterSaver CTPR4411.

2.19 CEILING SERVICE PANEL [CSP]

- A. Powder coated steel ceiling service panel. Panel shall be furnished complete with junction boxes, outlets, quick-connect fittings, flexible piping and cabling, and all other components required to bring indicated services to the Movable Bench System or Laboratory Tables. Service panels shall be designed to integrate within a standard 15/16" wide ceiling suspension system grid. Provide additional support/bracing as needed to support ceiling service tiles. Tiles should not be supported by ceiling grid alone.

- B. Construction: Minimum 18 gauge cold rolled steel with urethane powder coat finish.
- C. Color: White.
- D. Nominal Dimensions:
  - 1. Height (including electrical junction boxes): 3 inches.
  - 2. Width: As indicated on Laboratory drawings.
- E. Electrical Power Devices: Factory provided. UL labeled.
  - 1. Refer to Laboratory details for receptacle identification (NEMA configuration).
    - a. Twist lock, flush receptacles. Color: White.
  - 2. Cover plates: Type 302 stainless steel, #4 satin finish, with formed, beveled edges.
- F. Plumbing Service Fixtures:
  - 1. Ceiling Utility Panel system shall include locking, color-coded keyed quick-connect fittings for each service indicated. Each quick-connect shall include nipple and coupler with color-keyed band marking media.
  - 2. Refer to Laboratory details for required plumbing services.
- G. Plumbing Service Lines: Provided for connection of services from ceiling service panel to laboratory tables and equipment. For connections to movable bench systems refer to Modular Movable Bench System above.
  - 1. Air, Vacuum and other Non-burning Gases: Reinforced PVC hose.
  - 2. Natural and Reactive Gases: Braided stainless steel hose.
  - 3. Water: Reinforced PVC hose.
  - 4. Cooling Water: Color Coded Reinforced PVC hose.
  - 5. Length: 96 inches.
  - 6. Hoses to include keyed quick connect fittings.
- H. Power cords: Provided for connection of power from ceiling service panel to laboratory tables with table mounted power strip. For connections to movable bench systems refer to Modular Movable Bench System above.
  - 1. Single circuit, 3 wire power cord. Color: White cord with white plug.
  - 2. Length: 96 inches.
  - 3. NEMA L5-20P twist-lock plug with NEMA 5-15R receptacle.
  - 4. Provide an additional 5 drop cords for building to be used in future as needed if benches are removed.
- I. Blank Plates: Provide stainless steel cover plates at all electrical cut-outs where services are not required. Provide knock-outs of same finish as panel where plumbing services are not required. Provide plugs for all knock-out locations.
- J. Data cut out locations: Refer to Laboratory details for locations. Provide stainless steel cover plates for all unused cut outs.
- K. Coordinate pre-piping and wiring as required with Contractor. Shop Drawings shall clearly show all services to be provided at each panel location.
- L. Installation of services:
  - 1. Junction boxes for electrical and telecommunications services: All junction boxes shall be factory attached.
  - 2. All service fixtures shall be provided by the laboratory casework manufacturer and be factory installed.
  - 3. All electrical outlets shall be provided by the laboratory casework manufacturer and installed by others. Stainless steel cover plates shall be factory or field installed as approved by the Contractor. Coordinate installation with Contractor.
  - 4. Telecommunications outlets and all electrical and low voltage wiring shall be provided and installed by others. Coordinate installation with Contractor.
- M. Exposed piping and cabling from ceiling service panels to benches shall be concealed by a removable flexible plastic shroud/wrap with hook and loop closure.
  - 1. Basis of Design: Techflex, Flexo Wrap. Color: White.

## 2.20 OVERHEAD SERVICE CARRIER [OSC] TYPE 1 & 2

- A. A. Custom Fabricated Overhead Service Carrier:
  - 1. General Requirements:
    - a. Design per Drawings; coordinated with requirements of 05 4300 Channel Framing System and Divisions 22 and 26 for installation of electrical components and plumbing piping.
    - b. Carriers shall be shop fabricated to the greatest extent possible.
  - 2. Components:
    - a. Carrier structure to be Unistrut as shown in Laboratory Drawings. Structure to support 100 lbs per linear foot of shelving. Provide diagonal bracing above ceiling plane to resist a 100 plf load applied horizontally at the base of the assembly in any direction. Provide seismic bracing as required.
    - b. Shelving supports to be 3/4" threaded steel rods connected to superstructure of carrier.
    - c. Provide shelves in independent dimensions as shown on Laboratory Drawings. Shelving to be 1" resin work surface as specified under Work Surfaces within this Section. Bevel all edges and finish all surfaces.
    - d. Provide cylinder restraints and ladder support as detailed.
    - e. d. Provide power as shown on Laboratory and Electrical Drawings.
      - 1) Electrical raceway: Provided and installed by Division 26.
  - 3. Finish: All exposed metal surfaces, including framing members, to be acid-resistant, epoxy powder coated paint. Color to match metal casework.
  - 4. Manufacturer to coordinate with others trades for mounting of carrier to structure above.
  - 5. Manufacturer to provide service valves and piping to 10 feet above finished floor for final connections by others. Piping to match material indicated in Plumbing and HVAC Drawings. Exposed piping to be finished to match service carrier.

## 2.21 ELECTRICAL FITTINGS

- A. Power and data raceways and receptacles at laboratory casework: Specified in the electrical Specifications.
- B. Power receptacles at Modular Movable Bench Systems and table mounted power strips: Provided by Laboratory Casework manufacturer.
- C. General:
  - 1. All electrical fittings shall be UL labeled.
  - 2. Provide ground-fault circuit interrupters (GFCI) for fittings where indicated and when located in units containing water supplies or sinks.
- D. Electrical Pedestal Boxes:
  - 1. Type PD-1:
    - a. Style: Single wide, single faced box.
  - 2. Type PD-2:
    - a. Style: Double wide, double faced box.
  - 3. Finish: Satin aluminum with clear epoxy coating.
  - 4. Locations indicated on drawings.
- E. Electrical at Modular Movable Bench Systems: As indicated in Modular Movable Bench Systems above.
- F. Table mounted power strip:
  - 1. Manufacturers:
    - a. Byrne Electrical Specialists, [www.byrne.com](http://www.byrne.com)
    - b. ECA, [www.electri-cable.com](http://www.electri-cable.com)
    - c. Mockett, [www.mockett.com](http://www.mockett.com)
  - 2. Products:
    - a. Byrne, model Axil X, with Soba BESB-BL as indicated on Laboratory drawings.

- b. ECA, model Seclusion Series SECL 40 BL, with Cable Channel as indicated on Laboratory drawings.
- c. Mockett, model PCS48D, with WM8A-1-Channel Wire Manager as indicated on Laboratory drawings.
- 3. Features:
  - a. 4-qty receptacles, hospital grade.
  - b. Horizontal mount on 1 inch work surface, edge mounted with adjustable bracket.
  - c. Pre-Wired Power Cord:
    - 1) Type P1: Integral 72 inch long cord with circuit breaker. To be plugged into power cord provided with the Ceiling Service Panels.
    - 2) Type P2: Integral 120 inch long cord with circuit breaker. To be plugged into power cord provided with Overhead Service Carrier or adjacent wall receptacle.
      - (a) Refer to Overhead Service Carrier for power cord required.
  - d. Color: Black.
  - e. Cord Management Channel: Refer to Laboratory drawings for locations.
    - 1) 3/4 inch x 3/4 inch x 36 inch, adhesive backed plastic wire management channel. Refer to Laboratory drawings for required length.
    - 2) Attach to the underside of the work surface.
    - 3) Color: Black.
  - f. Gas valves: provide custom power strip with gas valves at Ceiling Service Panel 3 (CSP-3) locations.
    - 1) Location: provide gas valves mounted at each end of power strip
    - 2) Quantity: As shown on CSP
    - 3) Gas valves; finish, color and code as specified in this section for gas valves
    - 4) Quick disconnect valves and piping to valves
    - 5) Gas Lines, flexible, gas lines as specified in this section for Natural and Reactive Gases. Provide length required to reach from CSP to table power strip.
- 4. Provide a mockup of each option at one table for architect review prior to ordering model for project.
- 5. Locations indicated on drawings.
- G. Cover plates:
  - 1. AC outlets and devices:
    - a. Type 302 stainless steel, #4 satin finish, with formed, beveled edges.
    - b. Etched stainless steel: Etch directly on plate. Fill etched letters on cover plates with black enamel.
  - 2. DC or combination AC/DC outlets and devices:
    - a. Laminated plastic.
    - b. Etch laminated plastic strips to provide white lettering on black background.
    - c. Securely fasten to cover plate with non-corrosive fasteners or epoxy adhesive.
- H. Cover Plate Identification:
  - 1. Provide identification at receptacles, switches, terminal posts, and other locations as indicated.
  - 2. Letters: 1/4-inch-high letters, non-serif font.
  - 3. Identify the following devices:
    - a. AC receptacles, other than standard 125 volt duplex, grounding type. Indicate voltage and phase.
    - b. Switches and thermal overload switches. Indicate equipment being controlled (e.g., "FUME HOOD FAN").
    - c. Pilot lights when located remotely from associated equipment or switch. Indicate equipment or circuit being energized.

## 2.22 SAFETY STORAGE CABINETS

- A. Manufacturers:
  - 1. Eagle Manufacturing Co.; [www.eagle-mfg.com](http://www.eagle-mfg.com).



2. Justrite Manufacturing Co.; www.justritemfg.com.
  3. SciMatCo.; www.scimatco.com.
- B. Flammable Liquids Storage Cabinets:
1. Size: 16 gallon.
  2. Construction: 18 gauge cold rolled steel with double walls containing a 1-1/2 inch air space.
  3. Doors:
    - a. Sliding.
    - b. Self-closing:
      - 1) 3-point lock, self-latching.
      - 2) Continuous piano hinge.
      - 3) Fusible link.
  4. Shelves: Three, adjustable shelves; 350 lb/shelf capacity.
  5. Feet: Adjustable, leveling type.
  6. Color: Safety yellow.
  7. Signage: Hazard warning sign on door in compliance with ANSI Z535.2: "Flammable - Keep Fire Away".
  8. Fire resistance:
    - a. Meet requirements of OSHA 29 CFR 1910.106D, NFPA 30, and shall have Factory Mutual approval and labels, or be certified by an independent testing laboratory.
    - b. Grounding connection: Provide grounding connection point on the back of the cabinet for wiring to the building grounding system.
- C. Acid Storage Cabinets:
1. Size: 16 gallon.
  2. Construction: 18 gauge steel; double wall, top, bottom, and back construction, with 1/2 inch air space between faces.
  3. Doors:
    - a. Sliding.
    - b. Self-closing, swing:
      - 1) 3-point lock, self-latching.
      - 2) Continuous piano hinge.
      - 3) Fusible link.
  4. Shelves: Three, adjustable metal shelves; 500 lb/shelf capacity
    - a. Shelf trays: High density polyethylene.
    - b. Vents: 2 inch vent with fire baffle and cap.
    - c. Feet: Adjustable leveling type.
    - d. Color: Manufacturer's standard color.
    - e. Sign: "Caution - Acids/Corrosives"
  5. Fabricate in accordance with requirements for steel casework specified herein.
  6. Liner: Corrosion resistant liner.
  7. Ventilation:
    - a. Provide louver at top and bottom of each door.
    - b. When mounted below fume hoods, vent acid storage cabinet into fume hood. Provide 1-1/2 inch I.D., corrosion resistant, vent pipe up to fume hood enclosure. Locate vent openings at rear of fume hood work area with raised lip to avoid acting as drain for work surface. Vent shall provide positive airflow directly into the fume hood exhaust system.
  8. Shelf: Removable, half width, corrosion resistant lined shelf.
  9. Signage: Provide hazard warning sign on the door in compliance with ANSI Z535.2.

## 2.23 HEAVY DUTY SHELVING

- A. Manufacturers:
1. METRO, www.metro.com.; Product: MetroMax i Polymer Storage System.
  2. Cambro, www.cambro.com.; Product: Camshelving Premium Series.

3. Focus, [www.focusfoodservice.com](http://www.focusfoodservice.com).; Product: FPS-Plus Polymer Shelving
- B. Basis of Design: METRO, MetroMax i Polymer Storage System with MetroMax i Polymer Shelves.
  1. Dimensions: As indicated on drawings.
  2. Features:
    - a. Post: Corrosion proof, plastic/polymer construction with nylon adjustable leveling foot.
      - 1) Height as indicated on drawings.
    - b. Shelves: Adjustable in 1 inch increments. Quantity as indicated on drawings.
      - 1) Open grid shelf.
      - 2) Solid solid plastic/polymer shelf.
      - 3) Heavy duty dunnage shelf.
    - c. Weight capacity:
      - 1) Open grid shelf: 800 lb capacity per shelf.
      - 2) Solid solid plastic/polymer shelf: 800 lb capacity per shelf.
      - 3) Heavy duty dunnage shelf: 1200 lb capacity per shelf.
  3. Stem Casters: Where noted on drawings.
    - a. 900 lb rating per caster.
    - b. Include rubber bumpers.
    - c. 2-qty swivel and 2-qty swivel brake casters.

## 2.24 ACCESSORIES

- A. Stainless Steel Pegboards:
  1. Pegboard:
    - a. Material: 20 gauge, Type 304 stainless steel, No. 4 finish.
    - b. One-piece body with integral 4 inch drip trough.
    - c. Front face of board shall have multiple T-shape holes to accommodate pegs.
  2. Pegs: Removable 1/2 inch diameter, 6 inches long, white polypropylene. Mounted 45-degees.
  3. Drip trough shall have drain tube connector.
  4. Provide each wall mounted unit with wall hanger and stabilizer bracket kit.
  5. Accessories: PVC drain tube to sink.
- B. Cylinder Wall Bracket:
  1. Size: 1 cylinder: 8 inches wide.
  2. Components:
    - a. 11 gauge, epoxy powder coated steel channel bracket with non-marring edge guards.
    - b. Heavy duty strap and non-slip safety buckle for each cylinder.
  3. Support cylinder from 4 to 12 inch diameter.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Floors shall be level to within 1/4 inch in 10 feet, noncumulative, in any one direction.
- B. Final floor finish shall be completed prior to casework installation.
- C. Wall systems shall be completely installed and be plumb for installation of wall cabinets. Install all blocking and supports for wall cabinets. Wall system finish shall be complete including final painting.
- D. The ceiling system shall be in place including suspension grid and ceiling panels except at fume hoods and utility umbilical drops at island benches.
- E. The ceiling system shall be in place including finishes of gypsum board.
- F. Branch electrical circuits, including grounding conductors, shall be in place.
- G. HVAC grilles, call systems, and sprinkler heads shall be installed.

- H. Overhead electrical fixtures shall be installed and connected. Provide adequate lighting for installation of casework.
- I. Overhead mechanical lines shall be tested for leaks before finished casework is installed in any area.
- J. Where mechanical, electrical and HVAC service lines will be behind or under casework, service access or stubs shall have been installed at the appropriate rough-in point.
- K. Service lines for water, gas, vacuum, and special gases shall be flushed clean of dirt and chips, capped and tested for leaks prior to the connection of service fittings.
- L. No standing water shall be evident on the floor. Water producing operations such as masonry, terrazzo, and plaster shall be completed and cured prior to casework installation.

### 3.02 CASEWORK INSTALLATION

- A. Install plumb, level, true and aligned with no distortions. Shim, using concealed shims. Where laboratory casework abuts other finished work, scribe and apply filler strips for accurate fit with fasteners concealed. Fit scribe strips to irregularities of adjacent surfaces. Maximum gap opening shall be 0.025 inch.
- B. Base Cabinets: Set cabinets straight, plumb, and level. Adjust sub-tops within 1/16 inch (1.6 mm) of a single plane. Bolt continuous cabinets together. Fasten continuous cabinets to floor at toe space, with fasteners spaced 48 inches o.c. Secure individual cabinets with not less than two fasteners into floor, where they do not adjoin other cabinets. Assemble units into one integral unit with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.
- C. Wall Cabinets and Shelves: Fasten to solid supporting material, not plaster, lath, or wallboard. Anchor, adjust, and align wall cabinets as specified herein for base cabinets. Reinforcement of stud walls to support wall-mounted cabinets and shelves will be done during wall erection by trade involved, but responsibility for accurate location and sizing of reinforcement is part of this work.
- D. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
- E. Caulk between casework and wall .

### 3.03 WORK SURFACE INSTALLATION

- A. Field Jointing: Make in same manner as factory jointing using dowels, splines, adhesives, and fasteners recommended by manufacturer. Locate field joints as shown on accepted shop drawings, factory prepared so there is no job site processing of top and edge surfaces.
- B. Alignment: Abut top and edge surfaces in one true plane, with internal supports placed to prevent any deflection. Provide flush hairline joints in work surfaces.
- C. Installation Tolerances:
  - 1. Level: +/- 1/8 inch in 10 feet, noncumulative.
  - 2. Joint widths: 1/16 inch maximum wide at any location, flush with abutting edges. Horizontal alignment of top surface of all joints for their entire length shall be 1/32 inch. Fill joints.
  - 3. Front edges of all abutting units shall align.
  - 4. Visible gaps at cutouts with escutcheon or grommet: None.
- D. Cast Epoxy Resin Tops:
  - 1. Fastening: Secure to cabinets with silicone adhesive applied at each corner and along perimeter edges at not more than 48" o.c. Adhesive, rather than epoxy cement, allows for future disassembly and relocation.
  - 2. Workmanship: Abut top and edge surfaces in one true plane, with internal supports placed to prevent any deflection. Provide flush hairline joints in top units using clamping devices.

3. Tolerances: Provide joint widths not more than 1/16" wide at any location, filled and flush with abutting edges. Horizontal alignment of top surface of all joints for their entire length shall be within 1/32". Front edges of all abutting pieces shall align.
4. Surface Finish: After installation, dress joints smooth, remove any surface scratches, clean and polish entire surface.
5. Verify field dimensions and squareness of adjacent walls prior to installation.

#### 3.04 SERVICE FIXTURES AND FITTINGS INSTALLATION

- A. Refer to the mechanical Specifications for final connection of plumbing fixtures and fittings.
- B. Sinks and Cup Sinks:
  1. Install sinks with integral rim or sink ring, set in mastic or sealant to form a positive seal with the work surface.
  2. Remove excess mastic and sealant after sink is set.
  3. Apply 1/8 inch thick, heat resistant underseal to undersink surfaces to prevent condensation and provide sound deadening.
  4. Cast epoxy resin sink installation in cast epoxy resin work surface:
    - a. Underslung installation:
      - 1) Supports: Steel channels attached to ends of sink cabinet, adjustable by screw type rods.
      - 2) Set top edge of sink tight to underside of work surface, in chemical resistant sealing compound, for a tight and leak proof joint.
      - 3) Adjust sink and support to prevent movement.
      - 4) Remove excess sealing compound after sink is set.
    5. Surface mounted stainless steel sink installation:
      - a. Semi-flush installation:
        - 1) Frame, if integral rim seal not provided: Stainless steel, with clamping lugs and pads.
        - 2) Apply continuous coat of sealant under lip of rim and along edge of opening in work surface.
- C. Fume Extractor:
  1. Modify installation of ceiling bracket to conceal duct tie-in above ceiling.
  2. Provide ceiling trim at suspended acoustical ceiling.
- D. Utility Chase Closure (Umbilicals)
  1. Fasten to work surface and building structure.
  2. Seal edges of collars at work surface and ceiling.

#### 3.05 ACCESSORY INSTALLATION

- A. Install in a precise manner in accordance with manufacturer's directions.
- B. Turn screws to a flat seat; do not drive.
- C. Adjust moving parts to operate freely without excessive bind.

#### 3.06 INTERFACE WITH OTHER WORK

- A. Where access is required through items of laboratory casework, remove access panels, drawers, and other components, where they occur; make connections; and replace components.
- B. Perform field inspection and testing in accordance with Section 01400.

#### 3.07 ADJUSTING

- A. Adjust hardware and fittings for smooth operation.

#### 3.08 CLEANING AND PROTECTION

- A. Clean shop-finished surfaces, touch-up and remove or refinish damaged or soiled areas, as acceptable to [].
- B. Clean and polish epoxy resin countertops.

- C. Protection: Protect materials and installed laboratory casework and fixtures from subsequent construction operations.
- D. Laboratory casework and counters are not to be used as workbenches or work platforms for any portion of the work by any trade. Furniture and casework, as installed, is considered to be finished equipment and shall be protected from damage.
- E. Repair or remove and replace defective work as directed by the Architect upon completion of installation.

END OF SECTION

SECTION 12 36 00 - COUNTERTOPS AND WINDOW STOOLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Quartz Surface Countertops with Undermount Sinks.

1.02 SUBMITTALS

- A. Product Data: Provide data on specified component products.
- B. Samples: Submit two samples of countertop, 2 x 2 x 1/2 inch in size, illustrating color, texture, and finish.
- C. Shop Drawings: Indicate dimensions, thicknesses, backsplashes, sidesplashes, required clearances, materials, colors, finishes, field jointing, adjacent construction, design load parameters, methods of support, and anchorages.
  - 1. Indicate integration of plumbing components.
- D. Manufacturer's Installation Instructions.
  - 1. Indicate preparation of opening required.
- E. Maintenance Data: Indicate list of approved cleaning materials and procedures required; list of substances that are harmful to component materials.
  - 1. Include instructions for stain removal, surface and gloss restoration.

1.03 QUALITY ASSURANCE

- A. Fabricator: Manufacturer's authorized fabricator.

1.04 PROJECT CONDITIONS

- A. Verify that field measurements are as indicated.
- B. Sequence Work to permit installation of plumbing rough-in.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

- A. Refer to Section 01 60 00 - Product Requirements.

2.02 QUARTZ SURFACE MATERIAL

- A. Quartz Sheet: Homogeneous quartz and resin matrix.
- B. Thickness: 3 cm (1-3/16" nominal) sheet thickness. Provide total thickness and profile indicated on drawings.
- C. Color: As scheduled, or as selected by the Architect from manufacturer's full range.
- D. Joint Adhesive: Manufacturer's standard two-part epoxy, polyester, or acrylic adhesive to create color matched, nonporous joints, with a chemical bond.
- E. Panel Adhesive: Manufacturer's structural silicone adhesive.
- F. Sink Mounting Hardware: Manufacturer's approved sink clips, brass inserts and fasteners for attachment of undermount sinks.
- G. Sealant: Mildew resistant silicone sealant specified in Section 07 92 00.
  - 1. Color: Match quartz surface.
- H. Sinks: Refer to Division 23 section for undermount and top mounted sinks.

2.03 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
- B. Edge Detail: As indicated on drawings.
- C. Provide holes and cutouts for plumbing accessories as indicated on shop drawings.

D. Quartz Surfaces:

1. Form joints between components using manufacturer's standard joint adhesive. Provide joints no greater than 1/8 inch wide and without voids. Provide 4 inch wide support along entire seam.
2. Machine and finish component edges to a smooth, high gloss, uniform finish.
3. Rout cutouts then finish edges smooth.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates. Identify conditions detrimental to proper or timely installation. Do not commence installation until conditions have been corrected.

3.02 INSTALLATION

- A. Install components plumb, level true and straight in accordance with approved shop drawings, project installation details and manufacturer's printed instructions. Shim as necessary using concealed shims.
- B. Provide inconspicuous joints in finished work.

3.03 INSTALLATION - COUNTERTOPS

- A. Attach top securely to base unit or support brackets.
- B. Provide side splashes where countertops abut vertical walls.
- C. Provide back splashes where countertops abut vertical walls.
- D. Adhere undermount sinks to countertop using manufacturer's recommended adhesive and mounting hardware.
- E. Coordinate plumbing installation with Division 23.

3.04 CLEANING

- A. Clean fabrication surfaces in accordance with manufacturer's instructions.

3.05 PROTECTION OF FINISHED WORK

- A. Protect surfaces from damage until date of Substantial Completion. Replace damaged components that cannot be repaired to Architect's satisfaction.
- B. Review maintenance procedures with Owner's representative upon completion of project.

END OF SECTION

SECTION 20 00 00 - GENERAL MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.01 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.02 DESCRIPTION

- A. Intent of drawings and Specifications is to obtain complete systems, tested, adjusted, and ready for operation.
- B. Except as otherwise defined in greater detail, the terms "provide", "furnish" and "install" as used in Division 20, 21, 22 and 23 Contract Documents shall have the following meanings:
  - 1. "Provide" or "provided" shall mean "furnish and install".
  - 2. "Furnish" or "furnished" does not include installation.
  - 3. "Install" or "installed" does not include furnishing.
- C. Include incidental details not usually shown or specified, but necessary for proper installation and operation.
- D. Check, verify and coordinate work with drawings and specifications prepared for other trades. Include modifications, relocations or adjustments necessary to complete work or to avoid interference with other trades.
- E. Information given herein and on drawings is as exact as could be secured but is not guaranteed. Do not scale drawings for exact dimensions.
- F. Where Architectural features govern location of work, refer to architectural drawings.
- G. Contractor may install additional piping, fittings and valves, not shown on drawings, for testing purposes or for convenience of installation. Where such materials are installed, they shall comply with specifications and shall be sized to be compatible with system design. Remove such installed materials when they interfere with design conditions or as directed by Architect.

1.03 RELATED WORK

- A. Temporary Services:
  - 1. Division 01 - Temporary Facilities and Controls.
- B. Continuity of Service:
  - 1. No service shall be interrupted or changed without permission from Architect and Owner. Obtain written permission before any work is started.
  - 2. When interruption of services is required, Architect, Owner, and other concerned parties shall be notified and shall determine a time.
- C. Demolition:
  - 1. Division 02 - Selective Demolition.
  - 2. Perform demolition as required to accomplish new work.
  - 3. Accomplish work in neat workmanlike manner to minimize interference, annoyance or inconvenience such work might impose on Owner or other Contractors.



4. Unless otherwise noted, remove from premises materials and equipment removed in demolition work.
  5. Equipment noted to be removed and turned over to Owner, shall be delivered to Owner at place and time Owner designates.
  6. Where materials are to be turned over to Owner or reused and installed by Contractor, it shall be Contractor's responsibility to maintain condition of materials and equipment equal to that existing before work began. Repair or replace damaged materials or equipment at no additional cost to Owner.
  7. Where demolition work interferes with Owner's use of premises, schedule work through Architect, Owner and with other Contractors to minimize inconvenience to Owner. Architect must approve schedule before Contractor begins such Work.
- D. Concrete Work:
1. Provide cast-in-place concrete as required by Contract Documents unless otherwise noted.
  2. Concrete shall comply with Division 03 - Concrete.
  3. Provide anchor bolts, metal shapes and templates required to be cast in concrete or used to form concrete for support of mechanical equipment.
- E. Painting:
1. Painting of mechanical equipment will be done under Division 09 unless specified otherwise or unless equipment is to be furnished with factory applied finish coats.
  2. Equipment
    - a. Furnish equipment with factory applied prime finish unless otherwise specified.
    - b. If factory finish on equipment furnished by Contractor is damaged in shipment or during construction, refinish equipment to satisfaction of Architect.
  3. Piping:
    - a. Uninsulated Piping
      - 1). Paint cast iron, carbon steel, and copper piping located outside building and inside building within unfinished spaces without ceilings.
      - 2). Paint exposed fire protection piping.
      - 3). Paint exposed natural gas piping.
      - 4). Galvanized steel and stainless steel piping shall not be painted.
    - b. Insulated Piping
      - 1). Aluminum, stainless steel, PVC, and pre-colored insulation jackets shall not be painted.
    - c. Paint Colors
      - 1). Fire Protection: Red
      - 2). Natural Gas: Yellow
      - 3). Domestic Water: Green
      - 4). Sanitary Waste and Vent: Yellow
      - 5). Storm and Overflow: Green
      - 6). Chilled Water: Green
      - 7). Heating Hot Water: Yellow

#### 1.04 REQUIREMENTS OF REGULATORY AGENCIES

- A. Rules and regulations of Federal, State and Local Authorities and utility companies, in force at time of execution of Contract shall become part of this specification.

### 1.05 REFERENCE STANDARDS

- A. Agencies or publications referenced herein refer to the following:
1. AGA American Gas Association
  2. AMCA Air Movement and Control Association
  3. ANSI American National Standards Institute
  4. AHRI Air-Conditioning, Heating and Refrigeration Institute
  5. ASHRAE American Society of Heating Refrigerating and Air Conditioning Engineers
  6. ASPE American Society of Plumbing Engineers
  7. ASSE American Society of Sanitary Engineering
  8. AWS American Welding Society
  9. AWWA American Water Works Association
  10. ASME American Society of Mechanical Engineers
  11. ASTM American Society for Testing and Materials
  12. CDA Copper Development Association
  13. CISPI Cast Iron Soil Pipe Institute
  14. FMG FM Global
  15. FS Federal Specifications
  16. IEEE Institute of Electrical and Electronics Engineers
  17. MCA Mechanical Contractors Association
  18. MSS Manufacturers Standardization Society
  19. NEC National Electrical Code
  20. NEMA National Electrical Manufacturers Association
  21. NFPA National Fire Protection Association
  22. NIST National Institute of Standards & Technology
  23. NSF National Sanitation Foundation
  24. NSPI National Spa and Pool Institute
  25. OSHA Occupational Safety and Health Administration
  26. PDI Plumbing and Drainage Institute
  27. SMACNA Sheet Metal and Air Conditioning Contractors National Association
  28. UL Underwriters Laboratories, Inc.
  29. WQA Water Quality Association
- B. Work shall be in accordance with latest edition of codes, standards or specifications unless noted otherwise.

### 1.06 SUBMITTALS

- A. Shop Drawings (Product Data):
1. Refer to Division 01 - Submittal Procedures.
  2. Note that for satisfying submittal requirements for Divisions 20, 21, 22 or 23, "Product Data" is usually more appropriate than true "Shop Drawings" as defined in Division 01. However, the expression "Shop Drawings" is generally used throughout Specification.
  3. Submit shop drawings for equipment and systems as requested in the respective specification sections.

4. Specifically mark general catalog sheets and drawings to indicate specific items submitted and its correlation to specific designation for product in drawings.
  5. Specifically indicate proper identification of equipment by name and/or number, as indicated in specification and shown on drawings.
  6. When manufacturer's reference numbers are different from those specified, provide correct cross-reference numbers for each item. Clearly mark and note submittals accordingly.
  7. Submit complete record of required components when fixtures, equipment and items specified include accessories, parts and additional items under one designation.
  8. Include composite wiring diagrams for electrically powered equipment and devices.
  9. Where submittals cover products containing non-metallic materials, include "Material Safety Data Sheet" (MSDS) from manufacturer stating physical and chemical properties of components and precautionary considerations required.
  10. Submit shop drawings or product data as soon as practicable after signing contracts. Submittals must be approved before installation of materials and equipment.
  11. Submittals that are not complete, not permanent or not properly checked by Contractor will be returned without review.
- B. Certificates and Inspections:
1. Obtain and pay for inspections required by authorities having jurisdiction and deliver certificates approving installations to Owner unless otherwise directed.
- C. Operation and Maintenance Manuals:
1. Refer to Division 01 - Operation and Maintenance Data.
  2. Upon completion of Work but before final acceptance of system, submit to Architect for approval, 3 copies of operation and maintenance manuals in loose-leaf binders. If "one copy" is larger than 2" thick or consists of multiple volumes, submit only one set initially for review. After securing approval, submit 3 copies to Owner.
  3. Organize manuals by specification section number and furnish table of contents and tabs for each piece of equipment or system.
  4. Fire protection system shall be separately bound.
  5. Manuals shall include the following:
    - a. Copies of Shop Drawings
    - b. Manufacturer's operating and maintenance instructions. Include parts lists of items or equipment, with component exploded views and part numbers. Where manufacturer's data includes several types or models, designate applicable type or model.
    - c. CD ROM's of O&M data with exploded parts lists where available
    - d. Phone numbers and addresses of local parts suppliers and service companies
    - e. Internet/WEB page addresses where applicable
    - f. Wiring diagrams
    - g. Startup and shutdown procedures
    - h. Composite electrical diagrams
    - i. Flow diagrams
    - j. Lubrication instructions
    - k. Factory and field test records (Refer to Test and Balancing in Part 3 of this section.)
    - l. Air and water balance reports
    - m. Valve identification charts as specified in Section 20 0553 - Mechanical System Identification

- n. Access panel identification charts as specified in Section 20 0553 - Mechanical System Identification
  - o. Additional information, diagrams or explanations as designated under respective equipment or systems specification sections.
6. Instruct Owner's representative in operation and maintenance of equipment. Instruction shall include complete operating cycle on all apparatus.
7. Furnish O&M Manuals and instructions to Owner prior to request for final payment.
- D. Record Documents:
- 1. Refer to General Conditions of Contract, and Division 01 - Project Record Documents. Prepare complete set of record drawings in accordance with Division 01.
  - 2. Use designated set of prints of Contract Documents as prepared by Architect to mark-up for record drawing purposes.

### 1.07 JOB CONDITIONS

A. Building Access:

- 1. Arrange for necessary openings in building to allow for admittance of all apparatus.

B. Electrical Coordination:

- 1. Refer to Section 20 0513 - Motors
- 2. Contractors for Divisions 20, 21, 22 and 23 shall provide the following items as specified under their respective Division(s) (Division 20, 21, 22 and 23):
  - a. Motors
  - b. Electrically powered equipment
  - c. Electrically controlled equipment
  - d. Starters, where specified
  - e. Variable frequency drives, where specified
  - f. Control devices, where specified
  - g. Temperature Control wiring
  - h. Wiring diagrams to Electrical Contractor for apparatus indicating external connection and internal controls.
  - i. Disconnect devices furnished with units (VFDs, chillers, prepackaged control devices, etc.)
    - 1). Devices shall have an interrupting rating not less than that of the upstream overcurrent device as shown on electrical drawings.
    - 2). Equipment electrical connection points shall be labeled with listed electrical short circuit current rating (SCCR). SCCR shall not be less than interrupting rating of upstream overcurrent device as shown on electrical drawings. SCCR shall be marked on equipment control enclosure in accordance with UL508, or other acceptable, accredited third-party testing agency standards.
- 3. Electrical Contractor will provide the following devices required for control of motors or electrical equipment, unless noted otherwise.
  - a. Starters
  - b. Disconnect devices
  - c. Control devices:
    - 1). Pushbuttons
    - 2). Pilot lights

- 3). Contacts
    - d. Conduit, boxes and wiring for power wiring.
    - e. Conduit, boxes and wiring for control wiring, except temperature control wiring.
  4. Electrical Contractor will make connections, from power source to starter or variable frequency drive and from starter or variable frequency drive, where specified, to motor.
  5. Where starters or other similar control devices are furnished by this contractor, they shall be installed by this contractor and wired by Electrical Contractor.
  6. Should any change in size, hp rating, voltage, or means of control be made to any motor or other electrical equipment after Contracts are awarded, this contractor shall immediately notify Electrical Contractor of change. Additional costs due to these changes shall be responsibility of this contractor.
- C. Cutting and Patching:
1. Refer to General Conditions of the Contract, and Division 01 - Cutting and Patching.
  2. Perform cutting and patching required for complete installation of systems, unless otherwise noted. Patch and restore work cut or damaged to original condition. This includes openings remaining from removal or relocation of existing system components.
  3. Provide materials required for patching unless otherwise noted.
  4. Do not pierce beams or columns without permission of Architect and then only as directed. If openings are required through walls or floors where no sleeve has been provided, hole shall be core drilled to avoid unnecessary damage and structural weakening.
  5. Where alterations disturb lawns, paving, walks, etc., replace, repair or refinish surfaces to condition existing prior to commencement of work. This may include areas beyond construction limits.
- D. Housekeeping and Cleanup:
1. Refer to Division 01 - Closeout Procedures.
  2. As work progresses and/or as directed by Architect, periodically remove waste materials from building and leave area of work broom clean. Upon completion of Work, remove tools, scaffolding, broken and waste materials, etc., from site.
- 1.08 WARRANTY
- A. Refer to Division 01 for general warranty requirements.
  - B. Refer to technical sections for warranty requirement for each system.
    1. Where no warranty requirements are called out, warrant equipment, materials, and workmanship to be free from defect for 1 year after acceptance by Owner.
  - C. Warrant that systems will operate without objectionable noise, vibration and uncontrolled expansion.
  - D. Repair, replace or alter systems or parts of systems found defective at no extra cost to Owner.
  - E. In any case, wherein fulfilling requirements of any warranty, if this contractor disturbs any work warranted under another contract, this contractor shall restore such disturbed work to condition satisfactory to Architect and warranty such restored work to same extent as it was warranted under such other contract.
  - F. Warranty shall include labor, materials, and travel time.

## PART 2 PRODUCTS

### 2.01 PRODUCT SUBSTITUTIONS

- A. Refer to Division 01 - Product Requirements.

## PART 3 EXECUTION

### 3.01 GENERAL

- A. Verify elevations and dimensions prior to installation of materials.

### 3.02 DELIVERY, STORAGE, HANDLING, AND PROTECTION

- A. Deliver products to the site under provisions of Division 01.
- B. Store and protect products under provisions of Division 01.
- C. Store in clean, dry space.
- D. Maintain factory wrapping or provide cover to protect units from dirt, water, construction debris, and traffic.
- E. Handle in accordance with manufacturer's written instructions.
- F. Handle carefully to avoid damage to components, enclosure, and finish. Lift only with lugs provided for the purpose.
- G. Provide supplemental heat if required to prevent equipment from moisture contamination.
- H. Protect openings in equipment until connected to system to prevent entry of foreign materials.

### 3.03 EXCAVATION AND BACKFILL

- A. Refer to Division 31 - Earthwork.
- B. Provide excavation and backfill for underground work unless otherwise indicated. Blasting is not allowed on this project without written permission of Architect and Owner.
- C. Backfill trenches beneath concrete floor and stair slabs within building and beneath concrete slabs, walks, stairs and drives at exterior of building with gravel fill and compact to same density as surrounding area.

### 3.04 FLOOR, WALL, ROOF AND CEILING OPENINGS

- A. Coordinate location of openings, chases, furred spaces, etc., with appropriate Contractors. Provide sleeves and inserts that are to be built into structure during progress of construction.
- B. Remove temporary sleeves, if used to form openings, prior to installation of permanent materials. Utilize minimum 24 ga galvanized sheet metal for permanent sleeves unless otherwise noted.
- C. Provide Schedule 40 carbon steel pipe with integral water stop for steel sleeves required in interior floor slabs.
- D. Submit to Structural Engineer for review and approval size and location of core-drilled holes prior to execution.

- E. Submit product data and installation details for penetrations of building structure. Include schedule indicating penetrating materials (metal pipe, plastic pipe, conduit, etc.), sizes of each, opening sizes and sealant products intended for use.
- F. Where penetrations of fire-rated assemblies are involved, seal penetrations with appropriate firestopping systems as specified in Section 20 0573 - Mechanical Systems Firestopping.
- G. Submit complete penetration layout drawings showing openings in building structural members including floor slabs, bearing walls, shear walls, etc. Indicate and locate, by dimension, all required openings, including those sleeved, formed or core drilled. Drawings shall be approved prior to preparing openings in structural member.
- H. Provide minimum 1" clearance around penetration openings intended for pipe. Where fire resistant penetrations are required, size openings in accordance with written recommendations of firestopping systems manufacturer.
- I. Openings for underground pipes passing through foundations or under footings shall have minimum clearance of 1-1/2" to concrete. Do not disturb footing bearing soil.
- J. Openings for underground pipe passing through on grade concrete slabs shall have minimum 1/4" clearance to concrete. Seal openings with urethane caulk.
- K. Openings for insulated piping shall be sized based on outside diameter of insulation when it is specified or detailed to be continuous through opening.
- L. Openings for duct penetrations shall be no more than 1/2" larger on all sides than size of duct or duct including duct insulation, if applicable. Where firestopping systems are required at penetrations, size in accordance with recommendations of firestopping systems manufacturer, but opening shall not exceed 1" average clearance on all sides. Openings for ducts with fire dampers shall be in accordance with fire damper installation requirements.
- M. Duct penetrations through concrete floors in mechanical rooms containing liquid heat exchangers and/or pumps shall have 2" high water stopped curbs surrounding openings. This applies to mechanical rooms above the lowest floor level.
- N. Seal non fire-rated floor penetrations with non-shrink grout equal to Embeco by Master Builders, or urethane caulk, as appropriate.
- O. Seal non fire-rated wall openings with urethane caulk.
- P. Where penetrations occur through exterior walls into building spaces, use sleeves with integral water stop. For piping having outer surface temperature less than 150°F, use plastic (HDPE) sleeves, similar to PSI Link-Seal Model CS, rated to 150°F. For piping having outer surface temperature 150°F or higher, or where steel sleeves are shown or walls are fire rated, use steel sleeves with hot dip galvanizing, similar to PSI Link-Seal Model WS. Seal annular space between sleeves and pipe with Thunderline "Link-Seal" modular wall and casing seals, or sealing system by another manufacturer approved as equal by Engineer. Where "Link-Seals" are used with insulated pipe, insulation shall be butted against seals on both sides. Sealing system shall utilize Type 316 stainless steel bolts, washers and nuts.
- Q. In lieu of openings as specified herein penetration systems as manufactured by Pro Set may be used, including sleeve couplings and plug.
- R. If total Pro Set system with Water Guard "CR" is used, opening shall not need additional water proofing or riser clamps.

- S. Finish and trim penetrations as shown on details and as specified.
- T. Provide chrome or nickel plated escutcheons where piping passes through walls, floors or ceilings and is exposed in finished areas. Size escutcheons to fit pipe and pipe covering for finished appearance. Finished areas shall not include mechanical/electrical rooms, janitors' closets, storage rooms, etc., unless suspended ceilings are specified.
- U. Trim duct penetrations exposed in finished areas with 2" wide galvanized or aluminum trim collars properly sized to fit duct. Collars shall be same gauge as duct, prime finish unless noted otherwise. Finished areas shall not include mechanical rooms, janitors' closets, storage rooms, etc., unless suspended ceilings are specified.

### 3.05 EQUIPMENT SHUTOFF VALVES

- A. Provide shutoff valves at equipment connected to piping system. Refer to valve section or system section for requirements of valve type.

### 3.06 EQUIPMENT ACCESS

- A. Install piping, conduit and accessories to permit access to equipment for maintenance. Relocate piping, equipment or accessories to provide access at no additional cost to Owner.
- B. Install equipment with sufficient maintenance space for removal, repair or changes to equipment. Provide ready accessibility to equipment without moving other future or installed equipment (including light fixtures) or system components.
- C. Access doors in walls, chases, or inaccessible ceilings will be provided under Division 08 - Access Doors and Frames, unless otherwise indicated. Access doors for valves, shock stops or other equipment shall provide access for servicing, repairs, and/or maintenance.
- D. Provide necessary coordination and information to the Trade Contractor under Division 08 - Access Doors and Frames. This information shall include required locations, sizes, and rough-in dimensions.
- E. Provide access doors in walls, chases or above inaccessible ceilings for valves, shock stops, unions or equipment/devices requiring access for servicing, repairs or maintenance, unless otherwise noted. Access frames and doors shall be as manufactured by Milcor, Incorporated, or similar, of style applicable to surface. Provide access doors used in fire rated construction with UL Label. Provide steel, prime coated access doors unless otherwise specified. Provide stainless steel doors in ceramic tile walls, toilet rooms, locker rooms and in areas subject to excessive moisture. Provide access doors of sufficient size to allow complete maintenance. Coordinate location of access doors with General Contractor and rough-in equipment accordingly.

### 3.07 EQUIPMENT SUPPORTS

- A. Provide supporting steel not indicated on drawings as required for installation of equipment and materials including angles, channels, beams, hangers, etc.

### 3.08 EQUIPMENT GUARDS

- A. Provide equipment guards over belt driven assemblies, pump shafts, exposed fans, and elsewhere as indicated in this Specification or required by Code.
- B. Paint equipment guards bright yellow.
- C. Equipment guards shall comply with OSHA requirements.



### 3.09 SUPPORT PROTECTION

- A. In occupied areas, mechanical rooms and areas requiring normal maintenance access, guard certain equipment to protect personnel from injury.
- B. Provide minimum 1/2" thick Armstrong Armaflex insulation or similar product applied with Armstrong 520 adhesive on lower edges of equipment and mechanical supporting devices suspended less than 7 ft above floors, platforms or catwalks in these areas.
- C. Protect threaded rod or bolts at supporting elements as described above. Trim threaded rod or bolts such that they do not extend beyond supporting element and devices.

### 3.10 LEAD SHIELDING

- A. Wherever installation of this Contractor's equipment destroys radiologic integrity of wall, floor, or ceiling, this Contractor shall be responsible to provide suitable lead shielding to restore that integrity. Coordinate these requirements with General Contractor.

### 3.11 MECHANICAL SYSTEMS IDENTIFICATION

- A. Refer to Section 20 0553 - Mechanical Systems Identification

### 3.12 TEST AND BALANCING

- A. Tests for equipment, ductwork and piping systems shall be performed as specified in their respective specification sections in accordance with technical requirements noted.
- B. Provide equipment required for testing, including fittings for additional openings required for test apparatus.
- C. All ductwork and piping inspections and testing shall be successfully completed and approved before application of covering materials.
- D. When equipment or systems fail to meet minimum test requirements, replace or repair defective work or material as necessary and repeat inspection and test until equipment or systems meet test requirements. Make repairs with new materials. Caulking of holes or threaded joints is not allowed.
- E. Contractor is responsible for certifying in writing equipment and system test results. Certification shall include identification of portion of system tested, date, time, test criteria, test medium and pressure used, duration of test and name and title of person signing test certification document.
- F. Maintain copies of certified test results, including those for any failed tests, at project site. At completion of project, include copies of test records and certifications in O&M Manuals.
- G. Balancing of various systems shall be in accordance with associated specification sections in addition to requirements noted herein.
- H. If exterior domestic water supply also serves as source for fire protection systems, either exterior or interior or both, it shall be tested according to fire protection system requirements as specified in applicable Specification Section.

### 3.13 START-UP

- A. Systems and equipment shall be started, tested, adjusted and turned over to Owner ready for operation. This includes "Owner-Furnished, Contractor-Installed" (OFICI) and "Contractor-Furnished, Contractor-Installed" (CFCI) systems and equipment.

- B. Follow manufacturer's pre-start-up check-out, start-up, trouble shooting and adjustment procedures.
- C. Contractor shall provide services of technician/mechanic knowledgeable in start-up and check-out of types of systems and equipment on project.
- D. Provide start-up services by manufacturer's representative where specified or where Contractor does not have qualified personnel.
- E. Coordinate start-up with all trades.

### 3.14 LUBRICATION

- A. Upon completion of work and before turning over to Owner, clean and lubricate bearings except sealed and permanently lubricated bearings. Use only lubricant recommended by manufacturer.
- B. Contractor is responsible for maintaining lubrication of mechanical equipment under this Contract until Work is accepted by Owner.

### 3.15 CLEANING

- A. Clean systems after installation is complete.
- B. Clean piping and ductwork both internally and externally to remove dirt, plaster dust or other foreign materials. When external surfaces of piping are rusted, clean and restore surface to original condition.
- C. Clean pipeline strainers to restore them to original condition or replace with new strainer elements.
- D. Clean equipment and plumbing fixtures as recommended by manufacturers.
- E. Replace throwaway or replaceable media air filters used during construction period with new filters or new filter media after construction has been completed and before building is turned over to Owner. Filter replacement shall be as hereinafter specified.
- F. Blow and clean dirt, plaster dust and other foreign matter from coils, terminal devices, diffusers, registers and grilles.
- G. Thoroughly clean equipment of stains, paint spots, dirt and dust. Remove temporary labels not used for instruction or operation.
- H. Provide additional cleaning of individual piping systems and apparatus as hereinafter specified.

END OF SECTION

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SECTION 20 05 29 - PIPING AND EQUIPMENT SUPPORTING DEVICES

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 20 0549 - Seismic Anchorage and Restraints
- B. Section 20 0700 - Mechanical Systems Insulation
- C. Section 23 0550 - Vibration Isolation (Spring Hangers and Mounts)
- D. Section 23 3114 - Ductwork (for duct supports requirements)

1.02 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.03 DESCRIPTION

- A. Provide all supporting devices not provided as part of building structure or indicated on structural drawings or structural details, as specified and as required for proper supporting, anchoring, and guiding of piping, equipment, materials and systems.
- B. Support for all conditions of operation, including variations in installed and operating weight of equipment, piping and ductwork, to prevent excess stress and allow for proper expansion and contraction.
- C. Support of fire protection pipe shall comply with the latest adoption of NFPA 13 Standard for the Installation of Sprinkler Systems.

1.04 SUBMITTALS

- A. Shop Drawings for each piping system for all pipe sizes and all applicable equipment including, but not limited to, the following:
  - 1. Manufacturer's name
  - 2. Model numbers
  - 3. Materials of construction and load ratings (lbs)
  - 4. Schedule of hangers and support devices with pipe support spacing
  - 5. Insulated pipe supports along with application chart or table including pipe support spacing.
  - 6. Insulation protection saddles and weight bearing insulation table
  - 7. Details and calculations for sizing supplementary steel utilized for trapeze or specially designed supports
  - 8. Structural attachments, inserts, and concrete anchors. Submit ICC-ES Evaluation Report for each type of anchor.
  - 9. Calculations and drawings for concrete inserts and anchors for each application
  - 10. Drawings showing specific locations of any weld attachments to structure, including weight supported by such attachments
  - 11. Drawings showing specific locations of any suspended loads which exceed 100 lbs within joist chord panel to be attached to open web steel joist structural members. Include weight

supported by such attachments. (Panel is length of chord between two adjacent diagonal web members at point of connection to chord.)

12. Equipment mounting devices
13. Pipe guides and anchors
14. All other appropriate data

#### 1.05 DESIGN CRITERIA

- A. Materials and application of pipe hangers and supports shall conform to the latest requirements of ANSI/ASME B31 Code for Pressure Piping and MSS Standard Practice SP-58-2018 (Pipe Hangers and Supports Materials, Design, Manufacture, Selection, Application, and Installation), except as supplemented or modified herein.
- B. Support materials shall be steel or stainless steel unless specifically indicated.
- C. Support devices shall be factory fabricated and have published load ratings.
- D. Unless otherwise indicated, design supports, anchors, and related components with safety factor in accordance with AISC Manual of Steel Construction, but not less than 2.0.
- E. Determine maximum deflection using the following equation.

$$D = \frac{H \text{ or } L}{250}$$

Where            D = Max deflection in inches  
                      H = Member height in inches  
                      L = Member length in inches

- F. Unless otherwise indicated, hangers, support devices and hardware shall be steel and shall have factory standard black, primed, galvanized or electroplated finish for indoor application, and hot-dipped galvanized finish for outdoor application and corrosive atmospheres. Coat cut edges, welds or any damaged finish with galvanized paint.
  1. Corrosive atmospheres include the following locations:
    - a. Exterior locations
    - b. Chemical storage and hazardous waste storage rooms
- G. Materials in contact with pipe shall be galvanically compatible with piping material to eliminate conductive path for galvanic corrosion. Where piping and support materials have galvanic potential, Provide galvanic separation, such as nonmetallic coating or inserts between piping and metallic supports. Pipe insulation is acceptable galvanic separation. Materials in contact with pipe shall be galvanically compatible with piping material to eliminate conductive path for galvanic corrosion. Where piping and support materials have galvanic potential, provide galvanic separation, such as nonmetallic coating or inserts between piping and metallic supports. Pipe insulation is acceptable galvanic separation. Galvanic potential shall be determined by table below:

	<b>Galvanized Steel</b>	<b>Carbon Steel</b>	<b>Stainless Steel (Type 304 or 316)</b>	<b>Copper Brass Bronze</b>
<b>Copper, Brass, Bronze</b>	Yes	Yes	No	NA
<b>Stainless Steel (Type 304 or 316)</b>	Yes Note (1)	Yes Note (1)	NA	
<b>Carbon Steel</b>	No	NA		
<b>Galvanized Steel</b>	NA			

(1) Required where stainless steel surface area near interface is equal or greater than steel surface area

- H. Unless otherwise indicated, steel support devices exposed to ventilation air stream shall be stainless steel or steel with either galvanized finish or paint finish. Paint type shall be approved by Architect/Engineer.
- I. This Contractor is responsible for proper placement and sizing of supporting devices to accommodate insulation thickness and pitching of pipe. Coordinate with Contractor performing work specified in Section 20 0700 - Mechanical Systems Insulation.
- J. Where piping can be conveniently grouped to allow trapeze type supports, supporting steel shall be by means of standard structural shapes.
- K. Hangers and rods shall be plumb when pipelines are at their normal operating temperatures.
- L. Unless otherwise indicated, continuous insert channels are not allowed.
- M. Punching, drilling, or welding of building structural steel is not allowed unless approved by Structural Engineer.
- N. Refer to Structural Documents and ICC-ES Evaluation Report for application of concrete inserts and concrete anchors.
- O. Lateral braces shall be designed and detailed to apply loads as directly as possible to structural floor slabs, roof decks, or other building lateral elements. Braces shall not be applied to bottom flanges of steel beams or bottom chords of open web steel joists.
- P. Coordinate with General Contractor for any proposed weld attachments to building structure. This may result in use of welding codes or standards, which may apply to "structural work". and may necessitate repair of fireproofing and/or extension of fireproofing to support members. Execution of this work may be assigned to General Trades responsible for building structural steel. Cost for this work, however, will remain the responsibility of this Contractor.
- Q. Top or bottom chords of open web steel joists may be used to support loads, provided total load within panel does not exceed 100 lbs and load is placed concentric to joist. (Panel is length of chord between two adjacent diagonal web members at point of connection to chord).

- R. Fasteners including concrete anchors for seismic application shall have ICC Evaluation Service Report (ESR) and meet requirements of local authorities.

PART 2 PRODUCTS

2.01 STRUCTURAL SUPPORTS

- A. Unless specifically indicated on structural drawings, design and provide all supporting devices including miscellaneous steel (angles, channels, beams, etc.), required for proper support of piping, equipment and materials.

2.02 PIPE HANGERS AND SUPPORTS (METALLIC)

- A. Manufacturers: Anvil, Erico, Tolco, PHD, National Pipe Hanger Corporation, or B-Line, equal to Anvil figures listed. Corresponding MSS Type is indicated where applicable.
- B. Clevis and Roller Type Hangers:

<u>System</u>	<u>Pipe Size</u>	<u>Clevis</u>	<u>Roller</u>
Hot Pipes with Insulation (105°F and above)	2" and smaller	65 (MSS Type-1), 260 (MSS Type-1)	---
Ambient Bare Pipes (61°F to 104°F)	2" and smaller	65 (MSS Type-1), 260 (MSS Type-1)	---

- C. Flat Surfaces (Trapeze, Rack Type):

1. Use structural steel members such as struts, angles, channels and beams to support pipes as required. Select members properly for pipe support types and loading conditions. Refer to Part 1 for design criteria. Submit support details with type of members selected and load calculations. Provide straps, clamps, rollers or slides indicated below at each support point.

<u>System</u>	<u>Pipe Size</u>	<u>Straps or Clamps</u>	<u>Rollers</u>	<u>Slides</u>
Hot Pipes with Insulation (105°F and above)	2" and smaller	Anvil Klo-Shure	---	---
Ambient Bare Steel Pipes (61°F to 104°F)	6" and smaller 8" and larger	B-Line BVT Unistrut Cush-a-Clamp	---	---

2.03 INSULATION PROTECTION SHIELDS

- A. Anvil Fig. 167 (MSS Type-40) constructed of galvanized carbon steel. Per the latest edition of Standard MSS SP-58, select shield to accommodate outer diameter of insulation. Shield length and gauge for insulation compression strength not less than 15 psi, shall be as follows:

<u>Pipe Size</u>	<u>Length</u>	<u>Gauge</u>
1/4" thru 3"	12"	18

## 2.04 INSULATED PIPE SUPPORTS

### A. Description:

1. Products designed specifically for weight-bearing support of insulated pipes. Apply products in accordance with manufacturer's recommendations and requirements indicated below:
2. Refer to PART 3 – EXECUTION for application of Type A and Type B Insulated Pipe Supports specified below.

### B. General:

1. Supports shall be designed and rated for applied load, including weight of pipe, fluid, insulation, and any other imposed loads, with minimum 1.5 safety factor. Ratings shall be published by manufacturer and included in submittals.
2. Load ratings shall be established by pipe support manufacturer based upon testing and analysis conforming to the latest editions of ASME B31.1 and MSS SP-58.
3. High compressive strength inserts utilized to support loads shall encircle circumference of pipe. Block-style inserts are not allowed.
4. Supports shall be suitable for hot or cold pipe service as applicable.
5. Submit chart or table indicating selected model along with pipe sizes, rated loads, support device types and support spacing for each piping system.
6. Pipe support spacing shall be in accordance with manufacturer's recommendations but shall not exceed maximum spacing indicated under Hanger and Support Spacing in Part 3 of this Section.
7. Testing of insulation for compressive strength properties shall comply with ASTM D1621.
8. Insulation thickness shall match adjacent pipe insulation thickness.
9. Integrity of vapor barrier jacket shall be maintained continuously through support assembly.
10. Insulated pipe support style shall be specifically selected for the application and shall consider the following criteria at minimum:
  - a. Vertical, lateral and axial support design load limits.
  - b. Vertical, lateral, and axial support design travel limits
  - c. Temperature of support, at pipe surface, and ambient conditions
  - d. Test or pre-operational loads that may exceed normal operating conditions
  - e. Material for any items that will be welded directly to the pipe
  - f. Loading and displacements caused by seismic, hydraulic surge, or other forces
  - g. Temperature at support steel
11. All steel components shall have corrosion protection coating consisting of hot-dip galvanizing or zinc-rich primer coating.

### C. Type A Insulated Pipe Supports (Light Duty)

#### 1. Description:

- a. Pipe insulation specified in Section 20 0700 – Mechanical Systems Insulation with insulation protection shields specified in this Section. Weight-bearing inserts are not required.
- b. Type B or Type C supports may be utilized in lieu of Type A supports.

### D. Type B Insulated Pipe Supports (Standard Duty):



1. Manufacturers:
  - a. SNAPP ITZ insulation inserts by KB Enterprise, Tru-Balance Insulated Saddles by Buckaroos, Inc., Value Engineered Products, or approved equal.
  - b. Klo-Shure insulation couplings may be used for cold pipes insulated with elastomeric insulation. Mount shall be 7 Series Strup Mount with metal clamps or Clevis System for clevis hangers.
2. Description:
  - a. Load-rated assembly consisting of high compressive strength insulation material completely encompassing circumference of pipe, vapor barrier jacket, and insulation protection shield.
  - b. Insulation protection shield shall conform to ANSI/MSS SP-58. Shield shall be G90 galvanized steel and shall span full circumference of pipe insulation. Half-shields spanning lower 180° arc of insulation outer circumference will be acceptable when used with clevis hangers.
  - c. Axial length of insulation material shall be not less than 9" or 2" longer than insulation protection shields (1" minimum on each end), whichever is longer.
3. Insulation Materials:
  - a. Hot Pipes 105°F to 250°F:
    - 1). Rigid closed cell, polyisocyanurate or phenolic insulation by ITW, Resolco, or Kingspan. Minimum compressive strength shall be 100 psi.

E.

2.05 HANGER RODS (METALLIC)

- A. Rods shall conform to the latest MSS Standards except as modified herein. Furnish rods complete with adjusting and lock nuts.
- B. Rods shall have electroplated zinc or hot dip galvanized finish.
- C. Unless otherwise indicated, size rods for individual hangers and trapeze support as indicated in the following schedule. Rod size may be reduced one size for double rod hangers. Total weight of equipment, including valves, fittings, pipe, pipe content and insulation, shall not exceed limits indicated.

<u>Max. Pipe Size With Single Rigid Rod</u>	<u>Rod Diameter (inches)</u>	<u>Max Load (lbs) of Hanger Rod (Not exceeding 650°F Service Temp.)</u>
2"	3/8	730

- D. Threaded rods are not allowed in clean rooms.

2.06 BOLTS, NUTS, STUDS AND WASHERS

- A. ASTM A307, electroplated zinc finish

2.07 ROD ATTACHMENTS

- A. Anvil Fig. 290 (MSS Type-17), galvanized finish

## 2.08 U-BOLTS

- A. Anvil Fig. 137 (MSS Type-24), galvanized finish

## 2.09 BEAM CLAMPS

- A. Beam Clamps: Anvil Fig. 133/134 (MSS Type-21), 218 (MSS Type-30), 228 (MSS Type-28 or 29) and 292 (MSS Type-28 or 29)
- B. Top Beam Clamps: Anvil Fig. 227 (MSS Type-25)
- C. C-Clamps: Anvil Fig. 86, 92 or 93 (MSS Type-19 or 23) with set screw and lock nut

## 2.10 ADJUSTABLE PIPE SADDLE SUPPORTS

- A. Anvil Fig. 264 (MSS Type-38), galvanized finish. Provide Anvil Fig. 63 Type T stanchion with base, galvanized finish, where applicable.

## 2.11 CONCRETE INSERTS (WOODEN FORMED CONCRETE)

- A. Anvil Fig. 281 or 282, or Hilti HCI-WF (MSS Type-18), suitable for rod diameter and weight supported.

## 2.12 CONCRETE INSERTS (METAL DECK FORMED CONCRETE)

- A. Anvil Fig. 284, Tolco No. 109DD, B-Line Fig. B3019, DeWalt/Powers "Bang-It+", Hilti HCI-MD, or MSCO No. MX34.

## 2.13 CONCRETE ANCHORS

- A. Manufacturers: Hilti, DeWalt/Powers or Red Head
- B. Anchors shall be selected, sized, and detailed by Contractor's structural engineer registered in project's jurisdiction, based on project conditions and in accordance with project building code. Calculations and drawings shall be submitted.
- C. Anchors shall meet ICC Acceptance Criteria, and ICC-ES Evaluation Reports (ESRs) shall specifically list the current applicable codes.
- D. Anchors installed in hardened concrete for purpose of transmitting structural loads from one connected element to another, or for safety related elements such as sprinkler pipes, heavy suspended pipes, and barrier rails shall have ICC-ES report demonstrating anchors have met requirements of AC 193 for mechanical anchors in concrete elements.
- E. Post-installed expansion anchors and undercut anchors installed in hardened concrete shall be qualified for strength design and tested according to ACI 355.2. Designs shall be per the requirements of ACI 318, Appendix D.
- F. Anchors for seismic load application shall be approved by ICC-ES Evaluation Reports to resist seismic loads and selected to meet project seismic design requirements. Refer to Section 20 0549 – Seismic Anchorage and Restraints and Structural drawings.
- G. Anchors shall be zinc plated in accordance with ASTM B633.
- H. Select anchors with load ratings based on cracked concrete conditions.

#### 2.14 METAL FRAMING SUPPORT SYSTEM (STRUT SYSTEM)

- A. Manufacturers: Unistrut, B-Line Strut Systems, Anvil-Strut, Power-Strut, Erico, Superstrut, Kindorf, Hilti, and Hydra-Zorb
- B. Channels shall have epoxy paint or electroplated zinc finish.
- C. Channels shall not be lighter than 12 ga.

#### 2.15 EQUIPMENT RAILS

- A. Manufacturers: Roof Products & Systems, ThyCurb, Custom Curb, Inc. or Vent Products equal to Roof Products & Systems Model ER-4 with raised cant style. Mounting rails shall be galvanized steel with integral base plate, continuous welded corner seams, factory installed 2x4 wood nailer and 18 ga galvanized steel counter flashing.
- B. Mounting rail gauge shall be selected to support equipment adequately but shall be not less than 18 ga.
- C. Height shall be as detailed, but not less than 8" above finished roof.
- D. Equipment rails shall span minimum of 2 joists and not cantilever more than 6" where joists are used. Rails shall be level at top with pitch built in when deck slopes 1/4" per foot or greater.

#### 2.16 CASEWORK PIPE SUPPORTS

- A. Hinged pipe clamp and Strutcatcher, nylon 12 Grilamid, Clic by Litchfield International.
- B. Vibration isolation pipe clamp, yellow zinc chromate finish, B-Line BVT Series Vibraclamp or Kwik-Clip by B-Line.

#### 2.17 FIXTURE SUPPLY SUPPORT

- A. Galvanized steel stud support bracket, pre-drilled tube support mounting holes, adjustable stud width, Erico TSGB or equal.
- B. UV resistant nylon tube support, rated for 0°F through 130°F, resealable locking mechanism, Erico TPC or equal.
- C. Support bracket and tube support to be from same manufacturer.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install supports to allow for free expansion of piping. Support piping from building structural members using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. At no time shall hangers and supports overload building structural members. Fasten ceiling plates and wall brackets securely to structure and test to demonstrate adequacy of fastening.
- B. Select and size building attachments properly in accordance with MSS Standards and manufacturer's published load rating information.
- C. Coordinate hanger and support installation to properly group piping of all trades.
- D. Suspend piping hangers by means of hanger rods. Perforated band iron and flat wire (strap iron) are not allowed.

- E. Piping and ductwork shall be supported independently from other piping or ductwork.
- F. Pipe hangers and supports shall not penetrate vapor barrier of pipe insulation.
- G. Do not support equipment, or piping from metal roof decking or ceiling grid.
- H. Install adequate supports so as not to over stress either piping or equipment to which piping is connected.
- I. Refer to Section 20 0000 - General Mechanical Requirements for requirements of personnel injury protection guards for supporting devices.

3.02 HANGER AND SUPPORT SPACING

- A. Space pipe hangers and supports for horizontal pipe accordance with the following schedule, with exceptions as indicated herein:
- B. Steel Pipe (Standard Weight and Extra Strong):

<u>Pipe Size</u>	<u>Max Spacing</u>
1-1/4" and smaller	7'-0"
1-1/2"	9'-0"
2"	10'-0"

- C. Copper Tube (Unless Otherwise Noted):

<u>Pipe Size</u>	<u>Max Spacing</u>
3/4" and smaller	5'-0"
1" to 1-1/4"	6'-0"
1-1/2" to 2-1/2"	8'-0"

- D. Copper Tube (Domestic Water, Laboratory Water, Non-potable Water):

<u>Pipe Size</u>	<u>Max Spacing</u>
1-1/4" and smaller	6'-0"
1-1/2" and larger	10'-0"

E. Copper Tube (Domestic Water, Laboratory Water, Non Potable Water):

<u>Pipe Size</u>	<u>Max Spacing</u>
1-1/2" and smaller	6'-0"
2" and larger	10'-0"

F. Plastic Pipe

1. PVC Pipe:

<u>Pipe Size</u>	<u>Max Spacing</u>
All sizes	4'-0"

2. CPVC Pipe:

<u>Pipe Size</u>	<u>Max Spacing</u>
1" and smaller	3'-0"
1-1/4" and larger	4'-0"

3. PVDF Pipe (Waste and Vent):

<u>Pipe Size</u>	<u>Max Spacing</u>
2" and smaller	3'-0"
3" and larger	4'-0"

4. PP Pipe (Waste and Vent):

<u>Pipe Size</u>	<u>Max Spacing</u>
2" and smaller	3'-0"
3"	4'-0"
4"	4'-6"

5. PP Pipe (High Purity Water):

<u>Pipe Size</u>	<u>Max Spacing</u>
All sizes	Continuous sheet metal trough

6. PP-R Pipe (Potable and Nonpotable Water):

<u>Pipe Size</u>	<u>Max Spacing</u>
2" and smaller	4'-0"
3"	6'-0"

7. PEX-a Pipe (Potable and Nonpotable Water):

- | <u>Pipe Size</u> | <u>Max Spacing</u> |
|------------------|--------------------|
| 3" and smaller   | 2'-8"              |
- a. Pipe can be supported with PEX-a Pipe Channel as an alternate. Spacing for supports with pipe channel shall be 6' for pipes 3/4" and smaller and 8' for pipes 1" and larger.
  - b. Provide copper tube size riser clamps at base of each floor and at top of every other floor with mid-floor guides for hot water systems.
  - c. Provide copper tube size riser clamps at base of each floor and top of every 4 floors with mid-floor guides for cold water systems.
8. Support plastic pipe at all changes of direction. Adequate consideration shall be given to piping expansion.
- G. Cast Iron Pipe:
1. Maximum hanger and support spacing shall be 10 ft for all pipe sizes. Provide minimum of one hanger per pipe section close to joint on barrel, at each pipe fitting, at change of direction and branch connections.
  2. Support Cast Iron No-Hub pipe as recommended in CISPI Publication "Cast Iron Soil Pipe and Fittings Handbook, Chapter IV - Installation of Cast Iron Soil Pipe and Fittings."
- H. Borosilicate Glass:
1. Maximum hanger and support spacing for borosilicate glass piping shall be 10 ft.
  2. Support borosilicate glass pipe with padded hangers.
- I. Maximum spacing shown above may be restricted by strength of attachment to building structure. Submit data with calculations with published load ratings showing attachment to be utilized and maximum spacing allowable for that type of attachment and pipe size.
- J. Spacing less than indicated above may be required to conform to building structure design or loading limitations.
- K. Spacing less than indicated may be required depending on compressive strength of pipe insulation and insulated pipe supports.
- L. If pipe size changes between support points, maximum spacing shall be based on the smaller pipe size.
- M. If trapeze hangers are used to support multiple services, spacing shall be based on the most restrictive pipe size and material on trapeze hanger.
- N. For non-metallic pipe, follow manufacturer's installation recommendations in addition to requirements noted herein.
- O. Install supports for vertical piping and anchors as recommended by pipe manufacturer.
- P. Place hangers and supports to meet requirements of Section 23 2116 - Pipe and Pipe Fittings or specific pipe system sections, with regard to pitch for drainage and venting and clearance between services.
- Q. Hangers and supports shall bear on outside of insulation when pipes are to be insulated.
- R. Place hangers and supports within 1 ft of each fitting, such as elbows and tees, and at each valve, strainer, and other piping specialty for piping 4" and larger.

- S. Place hanger or support at first elbow upstream of pump inlet and first elbow downstream of pump outlet.

### 3.03 INSULATED PIPE SUPPORTS APPLICATION

- A. Install insulated pipe support at each support point of insulated pipe.
- B. Pipe Size 1-1/2" and Smaller:
  - 1. Use Type A insulated pipe support. Pipe insulation specified in Section 20 0700 - Mechanical Systems Insulation shall be continuous through support points.
  - 2. Use one shield (bottom) for clevis hanger.
  - 3. Use 2 shields (top and bottom) for roller hanger/support or strap/clamp support. Apply 2 metal straps to hold top and bottom shields onto insulation jacket.
  - 4. Type B insulated pipe supports may be used in lieu of Type A support.

### 3.04 CONCRETE INSERTS

- A. Concrete insert application, size, loading, and placement shall be this Contractor's responsibility.
- B. Coordinate with General Contractor for placement of inserts before concrete pour. Minimize use of inserts and anchors after concrete pour.

### 3.05 CONTINUOUS INSERT CHANNELS

- A. Mount continuous insert channels when used for pipe support on 8'-0" maximum centers and 2'-0" from corners.

### 3.06 BEAM CLAMPS

- A. Provide locknut for hanging rod at clamp.
- B. C-clamps are allowed for rod size 3/8" or smaller and only for static loading such as air piping, cold water piping, fire protection piping and, other similar piping. C-clamps are not allowed for hot water piping and steam and steam condensate piping, except hot water runouts to terminal heating devices.
- C. C-clamps are not allowed for open web steel joist application.
- D. C-clamps are not allowed for seismic application.

### 3.07 TRAPEZE SUPPORTS

- A. Construct trapeze supports with struts, angles, or channels and hang them by inserts or welded beam attachments and rods.
- B. Determine trapeze supports spacing by the smallest pipe on trapeze.

### 3.08 EQUIPMENT RAILS

- A. Use for all roof-mounted equipment, which is not curb mounted. Install bottom of equipment rail flat on roof deck. Insulate exterior of equipment rail.
- B. Flashing will be by General Contractor. Provide counter flashing as specified and secure to wood nailer with stainless steel truss head screws.

3.09 CONCRETE ANCHORS

- A. Anchor application, size, and placement shall be this Contractor's responsibility.

END OF SECTION



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SECTION 20 05 49 - SEISMIC ANCHORAGE AND RESTRAINTS

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 20 0529 - Piping and Equipment Supporting Devices
- B. Section 23 0550 - Vibration Isolation

1.02 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.03 DESCRIPTION

- A. Provide seismic anchorage and restraints of mechanical systems including, equipment, pipe and ductwork.
- B. Obtain services of Engineer registered and licensed in State of North Carolina to design seismic restraint systems and methods of anchorage to building structure. This shall include preparation of a quality assurance plan and performance of special inspections required by Chapter 17 of the North Carolina Building Code.

1.04 STANDARDS

- A. Seismic anchorage and restraints shall be designed and installed in accordance with Codes and Standards as enforced by Authorities Having Jurisdiction. Authorities shall include Owner's insurance company.
- B. Governing Codes shall include the following:
  - 1. Structural Engineering Institute/American Society of Civil Engineers Standard SEI/ASCE 7-05, Chapter 13 as amended by:
    - a. 2009 International Building Code, Section 1613
  - 2. NFPA 13 for Fire Protection Systems, 2007 Edition
  - 3. 2018 North Carolina Plumbing Code
  - 4. 2018 North Carolina Mechanical Code
- C. Where applicable, Building Standards supersede those of other evaluation or listing agencies referenced in Specification.
  - 1. Design shall be based on the following code information, Short Spectrum Seismic acceleration co-efficient ( $S_{DS}$ ) is 0.41 g.
  - 2. Geotechnical report indicates that the soils condition is Site Class D.
  - 3. Occupancy Category is III.
  - 4. Building Seismic Design Category is C.
  - 5. Non-hazardous and non-life safety systems shall have component importance factor ( $I_p$ ) of 1.0.
  - 6. Equipment, piping and ductwork systems containing hazardous materials shall have component importance factor ( $I_p$ ) of 1.5. For the purposes of seismic design, the following systems shall be classified as containing hazardous materials:

- a. Fume Hood Exhaust
- b. BSC Exhaust
7. Life safety systems shall have component importance factor ( $I_p$ ) of 1.5. The following systems shall be classified as life safety systems:
  - a. Fire Alarm System
  - b. Automatic Sprinkler System
8. For purposes of seismic design calculations, base of the building shall be considered first floor and the average roof height, with respect to base, shall be as indicated in Architectural design documents.
9. ( $F_p$ ) shall be determined in accordance with Equations 13.3-1, 13.3-2 and 13.3-3.
10. Lateral bracing forces shall be determined by registered Professional Engineer using equations listed in SEI/ASCE 7-05, Chapter 13.
11. In accordance with ASCE 7-05, Section 13.4.1, when shallow expansion anchors, shallow chemical anchors, or shallow (low-deformability) cast-in-place anchors are used, value of component response modification factor ( $R_p$ ) shall be 1.5 when determining forces in connected part, per ASCE 7-05, Section 13.3.1.

#### 1.05 SUBMITTALS

- A. Complete seismic restraint calculations, drawings and details.
- B. Submittal shall be sealed by Registered Professional Engineer.
- C. Submittal shall show evidence of coordination with project Structural Engineer.
- D. Submit for approval, seismic restraint calculations, drawings and details to Authorities Having Jurisdiction as required by these authorities.

### PART 2 PRODUCTS

#### 2.01 MATERIALS

- A. Materials and devices shall be in accordance with applicable codes and standards and shall be appropriate for intended use.
- B. Anchors and attachments to building structure shall be as approved by Structural Engineer.
- C. Seismic restraints used in conjunction with vibration isolators may consist of loose cables, telescoping pipes or box sections, angles or sections, flat plates used as limit stops or snubbers, or other types of housing used either integral with or separate from vibration isolators to accomplish necessary seismic restraints.

#### 2.02 EQUIPMENT

- A. Equipment shall meet General Design Requirements of ASCE 7-05, Chapter 13.2.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Secure stationary equipment, piping, ductwork and equipment supports to structure, concrete bases, or special supports to provide protection against earthquakes and to restrain lateral or

vertical movement. Where vibration isolators are used, design seismic restraints to limit lateral or vertical movement during earthquake, but without short circuiting vibration isolation system.

- B. Coordinate seismic restraints with project Structural Engineer and incorporate Structural Engineer's requirements.
- C. Seismic restraint methods and materials shall be supplementary to support devices specified in other sections of this specification and together shall serve as piping/ductwork systems and equipment support criteria.
- D. Installation of devices shall be in accordance with Registered Professional Engineer's drawings and details and in accordance with seismic guidelines.
- E. Coordinate installation of devices with other Contractors and incorporate their requirements.
- F. Refer to drawings and details for seismic restraint system concepts. Verify, revise and refine details in accordance with requirements of this Specification.
- G. If modification of duct, pipe and equipment locations is required for seismic restraint system, obtain written approval from Registered Professional Engineer before execution.
- H. Seismic restraint systems shall not interfere with installation of other building systems and access space as indicated on Drawings and as required
- I. Coordinate and schedule special inspections of systems and devices by the Seismic Design Engineer and submit report from Registered Professional Engineer to confirm compliance.

END OF SECTION

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## SECTION 20 05 53 - MECHANICAL SYSTEMS IDENTIFICATION

### PART 1 GENERAL

#### 1.01 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

#### 1.02 SUBMITTALS

- A. Product Data: For identification materials and devices
- B. Valve Schedules: For each piping system

### PART 2 PRODUCTS

#### 2.01 IDENTIFYING DEVICES

- A. Marker System:
  - 1. Manufacturers: Brady USA, Marking Services Inc. (MSI), Kolbi, or Seton
  - 2. Manufacturer's standard, preprinted with color coding, lettering size and length of color field according to ASME A13.1.
  - 3. Use pressure-sensitive type or "snap-on" type.
  - 4. "Strap-on" type may be used for piping over 6" size including insulation.
- B. Valve Tags:
  - 1. Minimum 1-1/2" diameter, 0.032" thick, polished brass or 316 stainless steel.
- C. Laminated Plastic Nameplates:
  - 1. Nameplates shall be approximately 1-1/2" x 4", 1/16" thick, and have 1/2" high lettering. Face of plastic nameplates shall be black with white letters.
  - 2. Fasteners shall be self-tapping, stainless steel screws or contact type with permanent adhesive.

### PART 3 EXECUTION

#### 3.01 GENERAL

- A. After painting and/or covering is completed, identify equipment and piping as indicated. Locate identification as conspicuously as possible except where such would distract from finished area.
- B. Where markers are used in high heat applications or exposed to harsh chemical or acid environments, specifically select marker materials for those applications.
- C. Coordinate, obtain and confirm mechanical systems identification criteria and requirements from Owner.

#### 3.02 PIPING SYSTEM IDENTIFICATION

- A. Install pipe identification on each system.

- B. Place flow directional arrows at each pipe identification location.
- C. Identify all piping (except medical gas) not less than once every 25 ft, not less than once in each room, at each branch, adjacent to each access door or panel, at each valve and where exposed piping passes through walls and floors.
- D. Identify piping with marker system.
  - 1. For "strap-on" type, ensure marker is fitted snugly to pipe or pipe insulation surface with sufficient straps.

### 3.03 VALVE IDENTIFICATION

- A. Identify valves with brass tags bearing system identification and valve sequence number in 1/2" black characters. Attach tag to valve body with brass jack chain and "S" hook for brass tag and SS jack chain or SS braided wires with swag sleeves and "S" hook for stainless steel tag. Non-metallic fasteners are not allowed.
- B. Valve numbers shall be prefixed with corresponding piping system identification in 1/4" black letters.
- C. Valve tags are not required at terminal devices unless valves are greater than 10 ft from device or located in another room not visible from terminal unit.
- D. Furnish typewritten valve schedule indicating valve number, fixtures, equipment or areas served by each numbered valve and incorporate in O&M Manuals.

### 3.04 DUCT SYSTEM IDENTIFICATION

- A. Install duct identification for each supply, return and exhaust air system.
- B. Identify all ductwork not less than once every 25 ft and not less than once in each room.
- C. Identify duct system by stenciling exterior of duct or insulation jacket by name as either "Supply Air (AHU-x)", "Return Air (RF-x)", or "Exhaust Air (EF-x)". "-x" shall indicate system number (e.g. AHU-1).
- D. Stencils shall be 2" (min) lettering, shall include direction arrow and shall be on bottom of duct or insulation jacket such that it is visible from floor below.
- E. Do not identify systems exposed in architecturally "finished" spaces.
- F. Hazardous ductwork shall have appropriate warning signs posted to protect personnel from exposure.

### 3.05 EQUIPMENT IDENTIFICATION

- A. Identify major equipment including fans and air terminal devices.
- B. Identify equipment by stenciling equipment number and service in 2" high letters.
- C. Identify control equipment and panels with laminated plastic nameplates.
- D. Nameplate Markings:
  - 1. Identify model number, size, capacity, electrical characteristics, serial number, along with other items scheduled for equipment on drawings.

2. Indicate motor horsepower, voltage, phase, cycles, RPM, full load amps, locked motor amps, frame size, manufacturer's name and model number, Service Factor, Power Factor, efficiency, minimum circuit amps, minimum feeder conductor size, disconnect or fuse size, refrigerant, and other pertinent information.
- E. Locate motor nameplates for easy reading. Relocate or provide new nameplates on motors if original nameplates are not located for easy reading.

### 3.06 ACCESS PANEL IDENTIFICATION

- A. Identify each service opening or access opening for fire, smoke, and fire/smoke damper with minimum 1/2" high letters indicating type of damper.
- B. Furnish typewritten charts with identification and location of all access panels serving equipment and valves and incorporate in O&M Manuals.

END OF SECTION



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SECTION 20 05 73 - MECHANICAL SYSTEMS FIRESTOPPING

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 07 8413 - Penetration Firestopping

1.02 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 - General Requirements.

1.03 SCOPE

- A. Work under this Section includes penetration firestop systems for the following:
  1. Through-penetrations or membrane penetrations of fire-resistance-rated walls (fire walls, fire barriers, smoke barrier walls, fire partitions, and smoke barrier walls) including both empty openings and openings containing pipes, ducts and other mechanical penetrating items.
  2. Through-penetrations or membrane penetrations of fire-resistance-rated horizontal assemblies (floor, floor/ceiling assembly and ceiling membrane of roof/ceiling assembly).
  3. Penetrations through non fire-resistance-rated assemblies (floors, floor/ceiling assemblies, ceiling membrane of roof/ceiling assemblies).

1.04 REFERENCE STANDARDS

- A. ASTM E-814 – Standard Test Method for Fire Tests of Penetration Firestop Systems
- B. UL 1479 – Standard for Fire Tests of Penetration Firestops
- C. FM 4991 – Standard for the Approval of Firestop Contractors

1.05 PERFORMANCE REQUIREMENTS

- A. Provide firestop systems and associated materials complying with applicable Building Codes (IBC Chapter 7, local codes, etc.) and requirements of Authority Having Jurisdiction (AHJ).
- B. Firestop system for each penetration shall have fire resistance rating complying with applicable Building Codes (IBC Chapter 7, local codes, etc.) and requirements of AHJ for F rating, T rating, and L rating, as applicable.
- C. Firestop systems shall be UL Classified for the application and listed in UL Fire Resistance Directory (FRD) or shall be qualified by equivalent testing and inspecting agency under ASTM E-814 and UL 1479.

1.06 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each penetration firestop system, provide applicable assembly detail(s) that evidence compliance with requirements for each condition indicated.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

- D. Material safety data sheets provided with product delivered to job-site.
- E. Certification of compliance with Building Codes of the State of project location in accordance with Article 1.5.
- F. Firestop Contractor's Qualification Data in accordance with Article 1.7.
- G. Onsite Training Letter: Provide letter from firestop manufacturer stating names(s) of the companies, person(s) in attendance and date of onsite training as required in Article 1.7 of this Section.

#### 1.07 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. A firm that has been approved by FM Global per FM 4991-Standard for the Approved of Firestop Contractors or has been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements" will be considered qualified.
  - 2. Firestop systems may be installed by a firm with successful experience in installing penetration firestop systems similar in material, design, and extent to that required for this Project. Qualifications include having necessary experience, staff, and training to install manufacturer's products per specified requirements.

#### 1.08 DELIVERY, STORAGE AND HANDLING

- A. Deliver penetration firestop system products to project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying manufacturer, product, type and UL Label where applicable.
- B. Store and handle materials for penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants or other causes.
- C. Handle in accordance with recommended procedures, precautions, or remedies described in material safety data sheets as applicable.

#### 1.12 WARRANTY

- A. Refer to Division 01 and Section 20 0000 – General Mechanical Requirements for general warranty requirements.
- B. Manufacturer shall provide standard 1-year warranty against defects in materials and workmanship for products specified in this Section. Warranty period shall begin after acceptance by Owner.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. 3M, Hilti, Tremco, Nelson, Specified Technologies Inc. (STI), or RectorSeal.
- B. ProVent Systems firestop products may be used for specific applications, provided products meet requirements in this Section.
- C. HoldRite HydroFlame firestop products may be used for specific applications provided products meet requirements in this Section.

## 2.02 MATERIALS

- A. Firestop Products: UL 1479, ASTM E814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements and fire-resistance rating involved for each separate instance; materials shall not contain flammable solvents.
- B. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to South Coast Air Quality Management District (SCAQMD) Rule #1168:
  - 1. Sealants: 250 g/L
  - 2. Sealant Primers for Nonporous Substrates: 250 g/L
  - 3. Sealant Primers for Porous Substrates: 775 g/L

## PART 3 EXECUTION

- A. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

## 3.02 INSTALLATION

- A. Comply with "System Performance Requirements" in Part 1 and with firestop system manufacturer's written installation instructions and drawings for products and applications indicated.
- B. If required, install forming/damming/backing materials and other accessories of types to support fill materials during application. After installing fill materials and allowing them to fully cure, remove forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Multiple items penetrating a single opening is not acceptable unless specifically indicated by the associated Approved penetration assembly detail(s).

## 3.03 IDENTIFICATION

- A. Identify penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated walls or horizontal assemblies, on both sides of each penetration, where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Label(s) shall comply with 1 or 2 below.
  - 1. Custom label with the following information:
    - a. The words: "Warning—Penetration Firestop System—Do Not Disturb. Notify Building Management of Any Damage."
    - b. Contractor's name, address, and phone number
    - c. Penetration firestop system designation of applicable testing and inspecting agency
    - d. Date of installation
    - e. Penetration firestop system manufacturer's name
    - f. Installer's name
  - 2. Manufacturer's preprinted labels with similar information per 1 above.

### 3.04 FIELD QUALITY CONTROL

- A. Provide certification by Installer that all penetration firestop systems have been installed in accordance with applicable Building Codes of the State of Project location.
- B. Firestop systems shall remain accessible and visible until inspection is complete, and inspection report is issued indicating firestop installation complies with requirements.
- C. Where deficiencies are found, repair or replace penetration firestop systems so they comply with specifications.

### 3.05 CLEANING

- A. Clean surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling.

### 3.06 FIELD QUALITY CONTROL

- A. Provide certification by Installer that all Through-Penetration Firestop Systems have been firestopped in accordance with applicable Building Codes.
- B. Proceed with enclosing Through-Penetration Firestop Systems with other construction only after inspection reports are issued.
- C. Where deficiencies are found, repair or replace Through-Penetration Firestop Systems so they comply with requirements.

### 3.07 IDENTIFICATION

- A. Identify Through-Penetration Firestop Systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6” of firestopping edge, so labels will be visible to anyone seeking to remove penetrating items or firestop 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. “Warning--Through-Penetration Firestop System—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.

### 3.08 CLEANING AND PROTECTION

- A. Clean surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as Work progresses.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is 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 and install new materials to produce systems complying with specified requirements.

END OF SECTION

SECTION 20 07 00 - MECHANICAL SYSTEMS INSULATION

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 20 0529 - Piping and Equipment Supporting Devices

1.02 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.03 DESCRIPTION

- A. Provide insulating materials and accessories as required for mechanical systems as specified below.
- B. Insulating products delivered to construction site shall be labeled with manufacturer's name and description of materials.

1.04 DEFINITIONS

- A. Concealed areas, where indicated in this Section, shall apply to shafts, furred spaces and space above finished ceilings, inaccessible tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.
- B. Unless otherwise indicated, unit of thermal conductivity is Btu·in/(h·ft<sup>2</sup>·°F).

1.05 SUBMITTALS

- A. Shop Drawings for each piping system for all pipe sizes, each ductwork system, and all equipment including, but not limited to, the following:
  1. Manufacturer's name
  2. Schedule of insulating materials
  3. Insulation material and thickness
  4. Jacket
  5. Adhesives
  6. Fastening methods
  7. Fitting materials
  8. Intended use of each material
  9. Manufacturer's data sheets indicating density, thermal characteristics, temperature ratings
  10. Insulation installation details (manufacturer's installation instruction/details, Contractor's installation details, MICA plates where applicable)
  11. All other appropriate data

1.06 DELIVERY, STORAGE AND HANDLING

- A. Insulation material shall be delivered to project site in original, unbroken factory packaging labeled with product designation and thickness. Shipment of materials from manufacturer to installation location shall be in weather-tight transportation. Protect insulation materials from

moisture and weather during storage and installation. Protect insulation material against long exposure to UV light from sun.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

#### A. Insulation:

1. Owens Corning, Johns Manville, Manson, Knauf or CertainTeed similar to product indicated except where product of manufacturers not listed above is specifically identified for special type of insulation.

#### B. Coatings, Mastics, Sealants and Adhesives:

1. Foster, Childers, Vimasco, Miracle or Pittsburgh Corning

### 2.02 MATERIALS

- #### A. Products used for or related to air conditioning and ventilating systems shall conform to NFPA 90A possessing flame spread index of not over 25 and smoke developed index no higher than 50.

- #### B. Unless otherwise indicated, all products, material itself or on composite basis, shall have flame spread index not more than 25 and smoke developed index not more than 50, when tested in accordance with ASTM E-84 or UL723.

- #### C. Insulation applied on stainless steel shall meet requirements of ASTM C795 and NRC 1.36.

### 2.03 INSULATION

- #### A. Insulation materials shall be fire retardant, moisture and mildew resistant, vermin proof, and suitable to receive jackets, adhesives and coatings as indicated.

- #### B. Glass fiber insulation shall be of inert inorganic material, non-corrosive to mechanical surfaces.

- #### C. Insulating cement shall be Quick-Cote by PK Insulation MFG Co. or Ryder GP, with dry density of no more than 38 lb/ft<sup>3</sup> thermal conductivity of 0.96 at 400°F mean temperature, and service temperature to 1200°F.

- #### D. Filling and finishing cement shall be Super-Stik by PK Insulation MFG Co., or Ryder MW, with dry density of no more than 24 lb/ft<sup>3</sup>, thermal conductivity of 0.74 at 500°F mean temperature, and service temperature to 1900°F.

#### E. Type A Insulation (Closed Cell Elastomeric Thermal Insulation):

1. Minimum nominal density of 6 lb/ft<sup>3</sup>, thermal conductivity not more than 0.25 at 75°F mean temperature, maximum water vapor transmission of 0.06 perm-inch and suitable for temperatures from -70 to 220°F, Armacell Model AP/Armaflex, K-Flex USA, or Aeroflex Model Aerocel.

#### F. Type F Insulation (Flexible Glass Fiber):

1. Minimum density of 0.75 lb/ft<sup>3</sup> with thermal conductivity of not more than 0.29 at 75°F mean temperature, and suitable for temperatures to 250°F. Owens Corning "All Service Duct Wrap", Johns Manville Microlite EQ Type 75, Knauf Atmosphere Duct Wrap.

#### G. Type R Insulation (Rigid Glass Fiber):

1. Minimum nominal density of 3 lb/ft<sup>3</sup> with thermal conductivity of not more than 0.23 at 75°F mean temperature.
2. Pipe insulation shall be premolded type in accordance with ASTM C547 Type I, suitable for temperatures to 850°F, Johns Manville Micro-Lok, Owens Corning Fiberglas ASJ/SSL-II or Knauf Earthwool 1000° pipe insulation.
3. Duct and equipment insulation shall be in accordance with ASTM C612, Type IA and IB, suitable for temperatures to 450°F, Johns Manville Spin-Glas Type 814, Owens Corning Type 703, Knauf Insulation Board.
4. Pipe and tank wrap faced with specified jacket may be used for equipment and round ducts insulation, provided that it meets all insulation characteristics requirements stated above and maintains same R-value as specified.

#### 2.04 JACKETS

- A. Jacket puncture resistances shall be based on ASTM D-781 test methods. Vapor barrier permeance ratings shall be based on ASTM E-96 Procedure A.
- B. Type D-1 Jacket:
  1. Heavy-duty, fire retardant material with glass fiber reinforcing. Jackets shall have neat, white Kraft finish suitable for painting, with beach puncture resistance of 50 units minimum. Vapor barrier shall be adhered to inner surface of jacket. Permeance shall not exceed 0.02 perm. Owens Corning "ASJ", Johns Manville "AP", Knauf "ASJ".
- C. Type D-2 Jacket:
  1. Glass fiber reinforced foil Kraft laminate with permeance not exceeding 0.02 perm and beach puncture resistance 25 units minimum. Owens Corning "FRK", Johns Manville "FSK", Knauf "FSK".
- D. Type P-1 Jackets:
  1. Heavy-duty, fire retardant material with glass fiber reinforcing and self-sealing lap. Jacket shall have neat, white Kraft finish suitable for painting, with burst strength of 1.5 Joules(50 beach units) minimum and tensile strength 45 lbs/in minimum. Vapor barrier shall be adhered to inner surface of jacket. Permeance shall not exceed 0.02 perm. Owens Corning "ASJ-SSL", Johns Manville "ASJ" and Knauf ASJ+.

#### 2.05 ADHESIVES, MASTIC, COATINGS, SEALANTS, AND REINFORCING MATERIALS

- A. Adhesives and sealants shall comply with the South Coast Air Quality Management District (SCAQMD) Rule #1168; VOC limits shall comply with Indoor Environmental Quality Section, Credit IEQ-4.1.
- B. Coatings and mastics shall comply with VOC limits set forth by Green Seal BS-11 and comply with the South Coast Air Quality Management District (SCAQMD) Rule #113; VOC limits shall comply with Indoor Environmental Quality Section, Credit IEQ-4.2.
- C. Products shall be compatible with surfaces and materials on which they are applied, and shall be suitable for use at operating temperatures of systems to which they are applied.
- D. Products shall be fire retardant, moisture resistant and mildew resistant and vermin proof.
- E. Vapor Barrier Mastic: Below ambient insulation. Water vapor permeance shall be less than 0.08 perms at 45 mils dry film thickness per ASTM F1249.
  1. Foster 30-33
  2. Childers CP-33



3. Vimasco 749
- F. Weather Barrier Breather Mastic: Above ambient insulation. Permeance shall be greater than 1.0 perms at 1/16" dry film thickness per ASTM E96.
  1. Foster 46-50 Weatherite
  2. Childers CP-10/CP-11 Vi Cryl
  3. Vimasco WC-5
- G. Lagging Adhesive/Coatings: Indoors applications used in conjunction with canvas/glass cloth.
  1. Foster 30-36
  2. Childers CP-50 AMV1
  3. Vimasco 713
- H. Glass fiber fabric reinforcing shall be 10 x 10 mesh similar to Childers Chil Glas #10 or Foster Mast A Fab.
- I. Wire mesh reinforcing shall be 22 ga, 1" galvanized.
- J. Insulation cement shall be ANSI/ASTM C195, hydraulic setting mineral wool.
- K. Finishing cement shall be ASTM C449.
- L. Butt joint and longitudinal joint adhesive for Type A insulation shall be Armstrong 520, Rubatex 373, Childers CP-82 or Foster 85-75.
- M. Weather-resistant protective finish for Type A insulation shall be equal to Armstrong WB Armaflex finish or Foster 30-64 elastomeric coating.

## 2.06 METAL BANDS AND WIRES

- A. Aluminum bands shall be 0.5" x 0.020" up to 48" diameter and 0.75" x 0.020" over 48" diameter.
- B. Stainless steel bands shall be 0.5" x 0.015" or 0.75" x 0.015".
- C. Stainless steel wires shall be 16 ga.

## 2.07 INSULATION FASTENERS

- A. Insulation fasteners shall be cup head weld pins, galvanized low carbon steel, minimum 12 ga (0.105") pins.
- B. Washer edge shall be beveled.
- C. Fasteners shall be stainless steel for stainless steel ductwork application.
- D. Insulation fasteners using adhesive are not allowed.

## PART 3 EXECUTION

### 3.01 APPLICATION

- A. Provide insulation and jackets as indicated in the following schedule. The schedule applies to both exposed and concealed applications unless noted otherwise:

<u>Service</u>	<u>Jacket Type</u>	<u>Insulation Type</u>	<u>Piping System</u>				
			<u>Insulation Thickness According to Pipe Size</u>				
			3/4" and less	1" - 1-1/4"	1-1/2" - 3"	4" - 6"	8" and Larger
Heating Hot Water (141-200°F)	P-1	R	1-1/2"	1-1/2"	2"	2"	2"
Domestic Cold Water	P-1	R	1"	1"	1"	1"	1"
	--	A	3/4"	3/4"	3/4"	3/4"	3/4"
(Type A Insulation is an option)							
Domestic Hot Water and Hot Water Return (105-140°F)	P-1	R	1"	1"	1-1/2"	1-1/2"	1-1/2"
	--	A	1"	1"	1-1/2"	1-1/2"	NA
(Type A insulation is an option.)							
Tempered Water	P-1	R	1"	1"	1-1/2"	1-1/2"	1-1/2"

<u>Service</u>	<u>Ductwork/Equipment System</u>		
	<u>Jacket Type</u>	<u>Insulation Type</u>	<u>Insulation Thickness</u>
Supply Ducts Exposed	D-1	R	1-1/2"
Supply Ducts Concealed	D-2	F	2"

- A. Type F insulation with Type D-2 jacket may be used in lieu of Type R insulation with Type D-1 jacket for ductwork located 6 ft or higher above floor in mechanical equipment rooms. Horizontal ducts that are not completely 6 ft above floor shall be insulated with Type R insulation as specified for its entirety.

### 3.02 INSTALLATION - GENERAL

- A. All insulation installation methods shall be performed in accordance with the latest edition of National Commercial and Industrial Insulation Standards published by MICA (Midwest Insulation Contractors Association) and manufacturer's installation instructions, except as modified in this Section of specifications.
- B. Install products with good workmanship, with smooth and even surfaces. Use full-length factory-furnished material where possible. Do not use scrap pieces.

- C. Apply insulation only on clean, dry surfaces, after all rust and scale have been removed and testing of systems has been completed. Do not insulate any section of system that must be pressure tested until after it has been successfully tested. Any removal and reinstallation to correct system defects prior to end of guarantee period shall be accomplished at no expense to Owner.
- D. Install insulating materials with necessary joints and terminations, to permit easy access and removal of equipment sections where inspection, service or repair is required, and to allow for expansion.
- E. Where possible longitudinal joints in jackets shall face toward wall or ceiling.
- F. Apply insulation to each pipe or duct individually. Common insulation applied to adjacent pipes or ducts will not be accepted.
- G. Unless otherwise indicated, pipe and duct insulation shall be continuous through walls and floors.
- H. Where multiple layers of insulation are used, stagger and secure each layer with metal bands.
- I. Where penetrations occur through fire-rated walls, partitions, or floors, provide fire seal as specified in Section 20 0000 - General Mechanical Requirements and Section 20 0573 - Mechanical Systems Firestopping.
- J. Insulate water piping within casework up to penetration of casework pipe chase at fixture stop. Insulate water piping within walls up to pipe penetration through the wall at fixture stop when serving wall-mounted fixtures. Termination of insulation shall be in neat and workman like manner with insulation jacket cap.
- K. Insulate the following systems for complete vapor barrier protection:
  - 1. Storm
  - 2. Clearwater Waste
  - 3. Cold Water
  - 4. All insulated ductwork
  - 5. All equipment with surface temperature below 65°F
- L. Apply Type A insulation for insulation and jackets requiring vapor barrier protection where specified insulations are cut for mounting sensors, control devices, parts of valves, devices or components which extend out from specified insulation to prevent condensation.

### 3.03 GLASS FIBER FABRIC COVERING (TYPE E-1 JACKET)

- A. Glass fiber fabric shall be fitted without wrinkles.
- B. Glass fiber fabric shall be sized immediately upon application with lagging adhesive and shall be capable of drying within 6 h.
- C. Apply adhesive and coating in accordance with manufacturer's recommendations.
- D. All seams shall overlap not less than 2".

### 3.04 PIPING, VALVE AND FITTING INSULATION

- A. Apply insulation to pipe, unions, flanges, fittings, valves and piping specialties with butt joints and longitudinal seams closed tightly. Valve insulation shall cover entire valve body including bonnets and packing nuts.

- B. Laps on factory-applied jackets shall be 2" minimum width firmly cemented with lap adhesive, or shall be pressure sealing type lap.
- C. Cover joints with factory furnished tape (3" minimum width) to match jacket. Cement firmly with lap adhesive. On systems requiring a vapor barrier (ASJ), vapo-seal all longitudinal and butt joints ASJ/Saran seams with 4" wide coat of vapor barrier mastic or 3" minimum tape.
- D. Where staples are used, they shall be on 6" maximum centers. When used for systems requiring vapor barrier, cover lap and staples with finish coat of vapor barrier mastic or 3" minimum tape.
- E. For finishing of insulated pipe fittings and valves where surface temperature of insulation is not higher than 125°F, use one piece PVC fitting covers, minimum thickness of 20 mil, Fitting cover shall be Johns Manville Zeston 2000 PVC, PROTO Fitting Covers, or similar by other manufacturers listed. Where fitting and valve insulation requires vapor barrier, seal joints of PVC covers with vapor barrier adhesives. Insulation type, R-value and density of insulation used at fittings shall match insulation of adjacent piping. Install insulation at pipe fittings and valves completely prior to applying PVC covers.
  - 1. For Type R (Rigid glass fiber) pipe insulation, PVC fitting covers with flexible mineral fiber blanket insulation inserts are acceptable, except those located in mechanical rooms within 6 ft above floor. For fitting covers located in mechanical room within 6 ft above floor, insulation inserts shall be pre-molded rigid fiber glass type wrapped around elbows.
- F. Stove pipe style insulation on elbows (Detail A on Plate 2-200 of MICA 8<sup>th</sup> Edition) is not allowed. It may be used for closed cell elastomeric insulation.
- G. Where terminations of pipe insulation are required, insulation shall have tapered ends, built up and finished as specified for fittings.
- H. For pipes 1-1/2" and smaller, install specified pipe insulation and jacket continuous through hanger or support locations. Install insulation protection shields to protect insulation from compressing.
- I. For pipes 2" and larger, where manufactured pre-insulated pipe supports are used at hanger or support locations, extend insulation to insulated pipe supports. Where vapor barrier is required, this Contractor shall be responsible for continuity of vapor barrier at insulated pipe supports. Use 3" wide vapor barrier tape on hot and cold systems at pipe supports.
- J. For pre-insulated pipe supports and insulation protection shields, refer to Section 20 0529 - Piping and Equipment Supporting Devices.
- K. For Contractor-fabricated anchors, secure insulation directly to pipe surface and extend insulation up anchor for distance of 4 times insulation thickness. For pre-insulated anchors, cover entire surface of anchors with Type A insulation. Where applicable, take special care to assure vapor seal at anchor.
- L. Where mechanical grooved pipe connections are used in piping system, insulate couplings as specified for pipe.
- M. Piping, fittings and valves not to be insulated:
  - 1. Heating hot water piping inside fin tube radiation enclosures
  - 2. Control valves and balancing valves for heating terminal devices
  - 3. Valves furnished with removable insulation/jacket
  - 4. Steam system traps

### 3.05 DUCTWORK AND COMPONENTS

- A. Apply duct insulation evenly over duct surface. Unless otherwise indicated, insulation and jacket shall run continuously between duct and duct supports. Maintain insulation thickness specified over duct reinforcing members.
- B. For support points of rectangular or oval ducts supported by trapeze hangers, place weight-supporting insulation at bottom of duct over trapeze. Weight supporting insulation inserts shall be minimum 6" long with same thickness as insulation specified and shall be Type G, H, P, or PP insulation. Size inserts based on compression strength and weight being supported.
- C. Flexible glass fiber insulation (Type F) may be installed outside of support for rectangular or oval ducts having width 60" or smaller and supported with strap hangers, provided that vapor barrier integrity is maintained at strap penetration.
- D. For support points of round ducts smaller than 16" diameter, weight-supporting insulation is not required for either rigid or flexible glass fiber insulation.
- E. For support points of round ducts 16" diameter and larger, place weight-supporting insulation between duct and strap or trapeze. Weight-supporting insulation shall be minimum 6" long with same thickness as insulation specified and shall be Type G, H, P or PP insulation. Size inserts based on compression strength and weight being supported.
- F. Flexible glass fiber insulation (Type F) may be installed outside of support for round ducts 24" diameter or smaller, provided that vapor barrier integrity is maintained at rod penetration.
- G. Securing glass fiber insulation (Type F, R, and RR) for rectangular or oval ductwork.
  - 1. Horizontal ductwork:
    - a. Secure to bottom of duct where duct width is 24" diameter or greater.
    - b. Secure to sides of duct where duct side is 24" diameter or greater.
  - 2. Vertical ductwork:
    - a. Secure to all sides where duct width is 18" diameter or greater.
  - 3. Install fasteners as required to secure, but not over 18" on center and within 3" of butt joint or edge.
  - 4. Fastener shall be weld pin mechanical type.
- H. Fastening insulation anchors to ductwork with adhesives is not allowed. Where weld pin fasteners are used, install them without damage to interior galvanized surface. Where weld pin fasteners cannot be used, use other type of fasteners such as metal bands.
- I. Where insulation is required for ductwork, provide insulation over entire ductwork system, including system components such as filters, mixing air chambers, sound attenuators, air measuring stations, reheat coils, etc. For fire dampers, smoke dampers and combination F/S dampers in ductwork requiring insulation, install insulation and jacket to wall and apply vapor barrier sealant to prevent condensation.
- J. Provide insulation over supply air diffusers, grilles and unlined boots after termination point of flexible ducts or rigid duct insulation to prevent from sweating.
- K. Where vapor barrier jackets are specified, pins and staples if used shall be jacketed over with matching material using 4" tape. Vaporseal insulation seams, punctures, and tears with two 4" wide tape.

- L. Insulation without factory jacket shall be cut and mitered to suit surface. Build up voids, seams and joints with insulating cement, cover with glass fabric and 2 coats of vapor barrier mastic as specified herein and finish to smooth surface.
- M. D-1 jackets:
  - 1. Butt together joints and seams firmly, cover with glass fiber fabric 4" minimum width and finish with 2 coats of vapor barrier mastic. Use of pressure sensitive tape is not acceptable.
- N. D-2 jackets:
  - 1. Butt together joints and seams firmly, cover with glass fiber fabric 4" minimum width and finish with 2 coats of vapor barrier mastic. Use of pressure sensitive tape is not acceptable.
- O. Ductwork not to be insulated:
  - 1. Internally lined ductwork
  - 2. Ductwork components with factory installed insulation
  - 3. Exposed supply and return ductwork in air conditioned spaces

END OF SECTION

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SECTION 21 13 14 - AUTOMATIC FIRE SPRINKLER SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

- A. This Section specifies materials, methods, and equipment to be used for automatic sprinkler system and related fire protection piping to 5 ft outside building.
- B. Research indicates there is no documentation or indication that microbiologically influenced corrosion (MIC) exists in the area of the project.
- C. Seismic requirements are part of this project. Hanging, bracing and restraint of fire sprinkler piping shall be in accordance with section 9.3 of NPFA 13. Shop drawings must include details and signify approximate locations of all seismic bracing. Calculations and layout of restraints shall be submitted to North Carolina State Construction Office for approval with shop drawings.
- D. This is not a Factory Mutual Global (FMG) protected property.
- E. This project is a revision to existing spaces. Minor sprinkler head relocations will be required to adjust to new wall conditions. A need for hydraulic calculations is not anticipated.
- F. Engineer of Record:
  - 1. Affiliated Engineers is Engineer of Record for fire protection systems for this project. Contractor shall install fire protection systems as indicated on Contract Drawings and as indicated in this section. Nothing in this Section is to preclude Contractor from normal coordination with other trades to provide installation, which complies with Local Codes or NFPA standards.
    - a. Contractor shall provide detailed layout drawings based on submittal requirements by Local Authority. These layout drawings shall be based on system as designed by Engineer of Record. Engineer of Record shall provide hydraulic calculations to be submitted to Local Authority.
- G. All work shall be installed in conformance with the governing codes, regulations, local ordinances, and requirements of Authorities Having Jurisdiction. It shall be the responsibility of the Fire Protection Contractor to familiarize themselves with all governing codes and requirements and report any noncompliance of the plans or specifications to the Construction Manager/Engineer, prior to entering into the contract. These requirements are minimum criteria and no reductions permitted by Code shall be allowed without written permission of the Engineer.
- H. No additional compensation shall be granted for work which must be changed as a result of the work not originally complying with codes and standards or not in accordance with the multiple trade coordination design criteria set forth in the contract documents.
- I. If code or other requirements exceed provisions indicated in the Contract Documents, the Construction Manager/Engineer shall be notified in writing. Where the work indicated on the Contract Documents exceeds code requirements, the installation shall be done in accordance with the Contract Documents. Any work done contrary to these requirements shall be removed and replaced at the expense of the responsible Contractor.
- J. Fire Protection Contractor shall become familiar with all details of the work, verify dimensions in the field, and advise the Construction Manager/Engineer of any discrepancy prior to entering into the contract.



- K. Fire Protection Contractor shall file all drawings, pay all fees, and obtain all permits and certificates of inspection related to this work. Fire Protection Contractor shall arrange inspection with proper Authorities Having Jurisdiction and include all costs associated with said inspections in their bid.

#### 1.02 RELATED WORK

- A. Section 20 0000 – General Mechanical Requirements
- B. Section 20 0529 – Piping and Equipment Supporting Devices
- C. Section 20 0549 – Seismic Anchorage and Restraints
- D. Section 20 0553 – Mechanical Systems Identification

#### 1.03 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

#### 1.04 QUALITY ASSURANCE

##### A. Codes and Standards:

###### 1. This installation shall conform to the following:

- a. North Carolina Fire Code, 2010 Edition with amendments
- b. North Carolina Building Code, 2015 Edition Based upon 2012 IBC
- c. Local and State Building, Mechanical, and Fire Codes
- d. NFPA 13, Installation of Sprinkler Systems , 2013 Edition
- e. NFPA 25, Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2014 Edition
- f. NFPA 30, Flammable and Combustible Liquids Code, 2012 Edition
- g. NFPA 55, Compressed Gases and Cryogenic Fluids Code, 2013 Edition
- h. Underwriters Laboratories (UL) Fire Protection Equipment Directory

##### B. Contractor Installation Program:

- 1. Provide licensed persons employed by sprinkler contractor to perform planning, calculations, layout, installation, and testing of fire protection systems. The following are acceptable:
  - a. Licensed Professional Engineer
  - b. National Institute for Certification of Engineering Technologies (NICET) Level IV
  - c. Certified sprinkler designer
- 2. Provide journeyman sprinkler fitter(s) for installation and supervision.
- 3. Contractor shall be licensed in the State of North Carolina for installation of fire protection systems.
- 4. Contractor shall submit pre-qualification evidence of at least 3 projects of comparable size successfully completed with their Bid.
- 5. Distortion or misrepresentation of qualification evidence may result in contract cessation.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site under provisions of Division 01.
- B. Store and protect products under provisions of Division 01.

- C. All materials shall be stored in a clean, dry space.
- D. Promptly inspect shipments to insure material is undamaged and complies with Specifications. Storage and protection methods must allow inspection to verify products.
- E. Furnish pipe with plastic end-caps/plugs on each end of pipe. Maintain end-caps/plugs through shipping, storage and handling, and installation to prevent pipe-end damage and to eliminate dirt and construction debris from accumulating inside of pipe. Protect fittings and unions by storage inside or by durable, waterproof, aboveground packaging.
- F. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade.
- G. Offsite storage agreements will not relieve Contractor from using proper storage techniques.

#### 1.06 SUBMITTALS

- A. Shop Drawings on Items Specified:
  - 1. Pipe, Fittings, and Joints
  - 2. Sprinklers
  - 3. Hanger Assemblies
  - 4. Drawings
  - 5.
- B. Submit Material Safety Data Sheet (MSDS) for corrosion inhibitive paint.
- C. Include items listed in product section and additional items required to provide complete installation.
- D. Indicate by red marking or arrow, items that are to be provided, where more than 1 item appears on manufacturer's catalog sheet.
- E. Submit stamped and sealed drawings, product datasheets, hydraulic calculations, and a signed copy of the Owner's certificate to local Fire Department, Engineer, and Owner's insurance representative prior to installation or fabrication of system components.
- F. Include copy of Fire Department plan review letter in submission to Engineer.
- G. After review of layout drawings by Engineer of Record, submit drawings and calculations to Local Authority and Owner's Insurance Representative.
- H. Review of submittals does not relieve Contractor from coordinating installation of work with other trades, or from compliance with Codes and Standards.
- I. At completion of acceptance tests:
  - 1. Send copy of test log to Engineer
  - 2. Send copy of Contractor's Material and Test Certificates **[and fire pump test results]** to:
    - a. Engineer
    - b. Owner
    - c. Authority Having Jurisdiction
  - 3. Provide Owner with following:
    - a. Manufacturer's literature and instructions describing operation and maintenance of equipment and devices installed.

- b. Typewritten chart with identification and location of all access panels serving equipment and valves. Incorporate into Operation & Maintenance (O&M) manual.
- c. Typewritten valve schedule indicating valve number, fixture/equipment or areas served by each numbered valve. Incorporate into O&M manual.
- d. For additional O&M manual requirements, refer to Section 20 0000 – General Mechanical Requirements.

## PART 2 PRODUCTS

### 2.01 MATERIALS

#### A. Materials and Equipment:

1. Materials and equipment in system shall be new and current products of manufacturer regularly engaged in production of such materials and equipment.
2. Where 2 or more pieces of equipment are required to perform interrelated functions, they shall be products of same manufacturer.
3. Clean and cap pipe after fabrication and prior to placing pipe in building.
4. Mark pipe with tags that can be removed during installation so no permanent markings remain on unpainted pipe located in exposed areas.

#### B. Approval Guides:

1. Unless otherwise shown, products shall be UL Listed in the latest publication of the UL Fire Protection Equipment Directory for service intended.

### 2.02 PIPE

#### A. Above Ground:

##### 1. Carbon Steel, 2" and smaller:

- a. Pipe: Carbon steel pipe, Schedule 40, American Society for Testing of Materials (ASTM) A795 or A53
- b. Fittings:
  - 1). Malleable iron, threaded, Class 150, 300 psi Cold Water Pressure (CWP) rating, ASME B16.3
  - 2). Cast iron, threaded, Class 125, 175 psi CWP rating, ANSI B16.4
  - 3). Cast iron, flanged, Class 125, 175 psi CWP rating, ANSI B16.1
  - 4). Carbon steel butt weld, ASTM A234 Grade WPB/American Society of Mechanical Engineers (ASME) B16.9, standard weight, seamless
  - 5). Ductile iron or malleable iron, roll **[cut]** grooved for mechanical coupling, 175 psi CWP rating, malleable iron conforming to ASTM A47.
    - a). Acceptable manufacturers: Anvil Gruvlok, Tyco Grinnell, Victaulic, Viking, or equal
    - b). Fitting, gasket, and coupling shall be furnished by same manufacturer.
- c. Joints:
  - 1). Threaded, tapered pipe threads, ANSI B1.20.1
  - 2). Flanged, cast iron, 175 psi CWP rating, ANSI B16.1, square head machine bolts with semi-finished hexagon nuts, ASTM A183, neoprene gasket
  - 3). Welded, welding electrodes shall be Lincoln or equal with coating and diameter as recommended by manufacturer for type and thickness of work being done.
  - 4). Mechanical:

- a). Flexible mechanical, malleable iron, ASTM A47, equal to Victaulic Style 75
  - b). Rigid mechanical, ductile iron, ASTM A-536, equal to Victaulic Style 009N
  - c). Wet systems gasket: Grade E EPDM gasket per UL 157 and UL 213
  - d). Dry systems gasket: Victaulic “FlushSeal” or equal
2. Provide metal pipe’s exposed threads with corrosion inhibitive paint, equal to Rust-Oleum.
  3. Provide pipe identification system with flow directional arrows on fire protection pipe. For additional information about pipe identification, refer to Section 20 0553 – Mechanical Systems Identification.
  4. Plain end couplings (Roust-A-Bouts, Plainloks or similar couplings) are not allowed on either new or existing sprinkler systems.
  5. Adjustable drop nipples are not allowed on either new or existing sprinkler systems.
  6. Expansion joints:
    - a. Provide Metraflex FireLoop swing joints with flexible grooved couplings, pipe nipples, and grooved elbows installed per manufacturer’s installation instructions.
    - b. Refer to structural drawings for location of expansion joints.
    - c. Provide high pressure expansion joints and mechanical couplings where pressures exceed 175 psi water working pressure.
  7. Shop welded joints:
    - a. Welding electrodes shall be Lincoln or equal with coating and diameter as recommended by manufacturer for type and thickness of work being done.

## 2.03 SPRINKLERS

- A. Manufacturers:
  1. Unless otherwise noted below, shall be manufactured by Reliable, Tyco Fire Products, Viking, or equal.
- B. Automatic, having temperature and pressure rating suitable for location.
- C. Architect will review deviations from specified styles for approval prior to installation.
- D. Provide the following type of sprinklers.
  1. Type A: Unfinished areas such as mechanical spaces,
    - a. Standard Coverage, Brass Upright or Pendent, ordinary temperature class (155°F), Tyco Fire Products Model TY-FRB, Viking Microfast, or equal.
  2. Type B: In areas with ceilings.
    - a. Standard Coverage, Concealed Pendent, ordinary temperature class (155°F), Tyco Fire Products Model RFII, Viking Mirage, or equal adjustable sprinkler with 139°F temperature class cover plate, mounted flush with ceiling. Cover plate color shall match ceiling color and shall be factory-painted (i.e. by manufacturer).
  3. Type C: In areas where ceiling conditions do not permit installation of pendent sprinkler or finished area where sidewall sprinkler provides better coverage of hazard.
    - a. Standard Coverage, standard chrome finish, ordinary temperature class (155°F), Tyco Fire Products Model TY-FRB, Viking Microfast horizontal (HSW) or vertical (VSW) sidewall with Viking Microfast Model F-1 adjustable escutcheon, or equal.
- E. Submit samples for examination and approval when appearance is different than sprinkler specified.

- F. Temperature class of sprinklers shall vary if installed close to heat sources, under skylights or in special hazard areas. Refer to NFPA 13 for requirements.
- G. Provide high pressure sprinklers where pressures exceed 175 psi working water pressure.

#### 2.04 HANGERS

- A. Acceptable manufacturers: Afcon, Anvil, Eaton, Pentair, Tolco, or equal
- B. Concrete expansion hangers, when provided, are to be Hilti, Illinois Tool Works (ITW), Powers Fasteners, or equal
- C. Hanger rods shall comply with Manufacturer Standardization Society (MSS) standards and manufacturer's published load rating.
- D. Provide hanger rod, hanger rod attachments, pipe stands, bolts, U-bolts, nuts, studs and washers with electroplated zinc coating or with hot-dipped galvanized finish.
- E. Riser clamps shall be electroplated zinc coated or have a hot-dipped galvanized finish and shall not protrude more than 2" beyond edge of hole, Anvil Fig. 261 or equal.

#### 2.05 EARTHQUAKE BRACING

- A. Sprinkler system shall be protected from earthquake influence in accordance with requirements of NFPA 13 and as outlined in Section 20 0549 – Seismic Anchorage and Restraints.
- B. Provide flexible couplings, bracing, and other components required, compatible with piping material and jointing system used.
- C. Seismic detailing shall be included on contractor's fire protection system installation drawings.

#### 2.06 DIELECTRIC FITTINGS

- A. Acceptable manufacturers: Epco Sales, Lochinvar, Watts Regulator Co., Wilkins, or equal
- B. Insulating nipple, metal casing, inert thermoplastic lining, Clearflow dielectric fitting by Perfection Corporation or equal.
- C. Dielectric unions 2" and smaller; dielectric flanges 2" and larger; with iron female pipe thread to copper solder joint or brass female pipe thread end connections, non-asbestos gaskets, and pressure rating of not less than 175 psig at 180°F. Provide high pressure type when pressures exceed 175 psi water working pressure.

### PART 3 EXECUTION

#### 3.01 DESIGN CRITERIA

- A. Basis of Design:
  - 1. See Drawings for room, names, uses and hazard descriptions. Densities shall be provided on drawings.
- B. Fire Protection System Layout and Installation Drawings:
  - 1. Contractor shall review Design Drawings and Specifications, and shall provide installation drawings, calculations, and product datasheets.
  - 2. Conceal sprinkler piping above ceilings where possible.

3. Contractor shall consult with Architect during development of piping layout to avoid conflicts with general appearance. Pipe routing is a critical issue due to attributes of this building.
4. Submit stamped and sealed installation drawings, calculations and product data sheets for coordination review to: local Fire Department, Engineer, Architect, Owner's insurance representative, City of Cullowhee and other Authorities Having Jurisdiction prior to installation (see submittals).
5. Contractor shall be responsible to have examined "Reflected Ceiling" drawings as well as Mechanical, Electrical, Piping, Information Technology, Structural and Architectural building plans prior to system layout.
6. Contractor shall coordinate routing of piping with other trades and Architect.
7. Contractor shall participate in coordination process and shall not install piping prior to coordination with other trades.

### 3.02 INSPECTION

- A. Investigate site conditions; verify utility locations and elevations before start of excavation. Forward discrepancies to Architect/Engineer before proceeding with construction.

### 3.03 INSTALLATION

- A. Install sprinkler system and associated accessories according to requirements of NFPA 13 and as shown on drawings.
- B. .
- C. Install pipe, fittings, couplings, and valves according to requirements of manufacturer.
- D. Keep materials within listed temperature range to assure jointing in accordance with manufacturer's requirements.
- E. Pipe and fittings shall be of corresponding materials when assembled.
- F. Above Ground Pipe:
  1. Provide pipe identification system with flow directional arrows on fire protection pipe in accordance with manufacturer's installation instructions. For additional information, refer to Section 20 0553 – Mechanical Systems Identification.
  2. Coat exposed threads with corrosion inhibitive paint, equal to Rust-Oleum. Apply paint per manufacturer's instructions.
- G. Provide auxiliary drains at low points of systems per requirements of NFPA 13.
- H. Identify valve with brass tag denoting which flow switch is being tested, when test valves are located remote from flow switch.
- I. Clamp-on or saddle type fittings (i.e. mechanical tees) are not allowed. Outlet fittings inserted into holes drilled into piping or pipe-o-lets are not allowed.
- J. Provide reducing fittings or provide shop fabricated weld-o-lets to change pipe sizes in sprinkler/standpipe systems. No bushings or grooved reducing couplings, such as Victaulic Style 750, are allowed.
- K. Feed sprinklers, installed in finished ceilings, with swing joint, or return bend arrangement for final positioning in ceiling grid pattern during construction phases.
- L. Sprinklers **are** required to be installed in the center of ceiling tiles.

- M. Install sprinklers as recommended by manufacturer. Sprinklers shall be set level and at locations to avoid interference with spray pattern of sprinkler. When ducts and lights are obstructions to sprinkler distribution, provide additional sprinklers beneath obstruction.
- N. Make joints of threaded pipe by cutting pipe square and reaming inside.
- O. Use joint compound sparingly.
- P. Install joints for mechanical coupled pipe according to manufacturer's recommendations. Use manufacturer's gasket lubricant sparingly.
- Q. Pipe grooving shall be per coupling manufacturer's instructions.
- R. Welded joints shall be made in fabrication shop. No welding allowed at project site.
- S. Hangers, Bracing, and Restraint of System Piping:
  - 1. Provide hangers and associated parts to support piping in perfect alignment without sagging or interference, to permit free expansion and contraction, and meet requirements of NFPA 13 and manufacturer's installation instructions.
  - 2. Select and size building attachments per Manufacturer Standardization Society (MSS) standards and manufacturer's published load rating.
  - 3. Coordinate hanger support installation to group piping of all trades.
  - 4. Hang pipe from building members using either concrete inserts for concrete construction or beam clamps for steel construction. Installation shall comply with manufacturer's installation instructions. Expansion type inserts may be used for branch piping.
  - 5. Restraining clips/clamps are required in locations where vibration may be a concern. Refer to Section 23 0550 – Vibration Isolation, for additional information regarding restraining clips/clamps.
  - 6. Suspend hangers by means of electroplated zinc or hot-dipped galvanized finish hanger rods. Perforated band iron and flat wire straps (strap iron) are not allowed.
  - 7. Mains parallel to joists shall not be supported from a single joist. Mains parallel to joists shall be supported by trapeze hanger and be positioned equally between two joists. Trapeze hangers shall be positioned to load joists at panel points only.
  - 8. Support pipe from top flange of beams.
  - 9. Where joists are used, locations of pipe supports shall be approved by the structural engineer prior to installation.
  - 10. Do not support equipment or piping from metal roof deck.
- T. Support piping in accordance with NFPA 13 and Section 20 0549 – Seismic Anchorage and Restraints, and in accordance with State and Local seismic restraint requirements.
- U. Include seismic restraint details with sprinkler installation drawings.

### 3.04 CLEANING

- A. Flush sprinkler system to purge cutting oil, debris and metal fines.
- B. Ensure underground feed pipe has been flushed per NFPA 24 to clear out construction debris, prior to connecting aboveground fire protection system to it.
- C. Clean systems after installation is complete.
- D. Clean piping both internally and externally to remove dirt, plaster dust, or other foreign materials. When external surfaces of piping are rusted, clean and restore surface to original condition.

Replacement of heavily soiled and deteriorated materials shall be done at the Contractor's expense.

- E. Clean equipment as recommended by manufacturers. Thoroughly clean equipment of stains, paint spots, dirt, dust, and any other foreign materials. Remove temporary labels not used for instruction or operation.

### 3.05 TESTING

- A. Refer to testing paragraph of Section 20 0000 – General Mechanical Requirements.
- B. Perform all NFPA required acceptance tests.
- C. Test sprinkler system as entire system or partial system. System shall be hydrostatically tested at not less than 200 psi or 50 psi above static pressure in excess of 150 psi for 2 h. No leakage allowed. Replace defective joints with new materials. No caulking of defective joints allowed. Re-test system after defective joints are replaced, until satisfactory results are obtained.
- D. Pipe shall not be concealed until satisfactorily pressure tested.
- E. In addition to hydrostatic test dry pipe system shall be air pressure tested at 40 psi for 24 h. Leakage in excess of 1-1/2 psi during 24 h will not be permitted.
- F. Owner's representative or engineer may witness tests. Contractor shall notify Owner and Engineer a minimum of 3 days in advance to allow for participation.
- G. Log of tests shall be kept at job site and shall identify:
  - 1. Who performed test
  - 2. Time of test
  - 3. Date of test
  - 4. Section of system tested
  - 5. Results of test
  - 6. Completed Contractor's Material and Test Certification form(s) from NFPA 13
- H. Operate flow and pressure switches to test that signals are transmitted to Fire Alarm Control Panel.
- I. Include test for tamper switches.

END OF SECTION



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SECTION 22 00 00 – GENERAL PLUMBING REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION

- A. Specification requirements defined in Division 20 of this Specification apply to, and are in addition to the work associated with equipment, systems, materials, and installation requirements specified in Division 22. Contractor shall provide the requirements specified in Division 20 to obtain complete systems, tested, adjusted, and ready for operation.

1.02 RELATED WORK

- A. Section 20 0000 - General Mechanical Requirements
- B. Section 20 0529 - Piping and Equipment Supporting Devices
- C. Section 20 0549 - Seismic Anchorage and Restraints
- D. Section 20 0553 - Mechanical Systems Identification
- E. Section 20 0573 - Mechanical Systems Firestopping
- F. Section 20 0700 - Mechanical Systems Insulation

PART 2 PRODUCTS

2.01 NOT APPLICABLE TO THIS SECTION.

PART 3 EXECUTION

3.01 NOT APPLICABLE TO THIS SECTION.

END OF SECTION

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SECTION 22 05 94 - DOMESTIC WATER SYSTEMS BALANCE

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 22 1118 – Water Distribution System
- B. Section 22 2114 – Plumbing Specialties

1.02 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.03 DESCRIPTION

- A. Plumbing Contractor shall be responsible for providing complete testing and balancing work of liquid fluid handling systems, such as domestic hot water return, laboratory hot water return, water mixing valves, and other processes included in this Project.
- B. Work required shall consist of setting volume flow rates and adjusting speed controls, recording data, making tests, and preparing reports as specified herein.
- C. Scope of work includes new work specified herein and includes all equipment, distribution systems, and terminal units connected.
- D. Scope of work also includes existing liquid fluid handling systems as defined by drawings and/or schedules.
- E. Work is limited to new areas within construction boundaries and does not include central pumping equipment or other areas. Adjust and balance flows to values indicated or scheduled. If flow is abnormal, attempt to proportional balance flows to the same percentage below design and contact Engineer for additional instruction.
- F. Procedures shall be in accordance with the latest edition of AABC or NEBB and as per detailed herein.
- G. TAB work shall be performed by persons trained in TAB work and certified by Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB). Contractors who are members of AABC or NEBB and who have qualified personnel available to perform work may submit Quality Assurance Submittal for approval.
- H. Contractors who are members of AABC or NEBB and who have qualified personnel available to perform Work may submit Quality Assurance Submittal for approval. Contractors who cannot meet these requirements shall subcontract with independent TAB Contractor. TAB subcontractor shall prepare Quality Assurance Submittal for Contractor who will submit it for approval.
- I. Owner will separately contract with an independent TAB Contractor to perform all testing, adjusting and balancing of HVAC hydronic systems required for this Project. Work related to testing, adjusting, and balancing that must be performed by Mechanical Contractor is specified in other sections of these Specifications.
- J. Upon direction of Architect/Engineer or TAB subcontractor, Contractor shall provide (at no additional cost to Owner) any additional work and/or devices necessary to properly balance the

system, including calibrated balancing valves, gauge tappings, flow sensors, and thermometer wells. Contractor shall be responsible for trimming and balancing pump impellers as necessary to obtain design pump flow rates at minimum pressure differential.

- K. TAB work shall not proceed until all assigned personnel have been approved by, Engineer via Quality Assurance Submittal. Coordinate each phase of TAB work with overall project schedule. Each phase of TAB work shall be done in timely manner as detailed herein. Fieldwork must be complete before occupancy. Certificate of Substantial Completion shall not be issued until after Final Report is accepted by Engineer.

#### 1.04 SUBMITTALS

##### A. General:

1. Make submittals in accordance with Section 01 3300 – Submittals. Submit minimum of 5 copies of all submittals unless otherwise directed.
2. Reports shall be assembled using a 3-ring hard cover binder with Project Name and location on the cover and the side panel. Information sheets shall be 8-1/2" x 11" white bond paper. Use pre-printed forms of NEBB or AABC wherever possible. Assemble report in the following order.
  - a. Transmittal letter
  - b. Cover sheet with Project title, location, submittal date, and names and addresses of Owner, Contractor, TAB subcontractor, Architect, and Engineer
  - c. Index of numbered tabs listing major systems
  - d. Data organized by system in the following order:
    - 1). Equipment data and measurement summary
    - 2). Equipment measurement data
    - 3). Branch main measurement data
    - 4). Terminal device measurement data
  - e. Provide numbered tabs for each system.

##### B. Quality Assurance Submittal:

1. Within 30 days of signing Contract, Contractor shall submit the following information:
  - a. Firm resume
    - 1). AABC or NEBB active membership required
    - 2). Names of 3 recent relevant completed projects along with the project address, Owner's contact person, supervising design professional.
  - b. Supervisor resume
  - c. Balance technician(s) resume
2. Architect/Engineer and Owner reserve the right to contact previous project representatives and to reject persons whom Architect/Engineer and/or Owner feel are not qualified for this Project due to lack of relevant experience or problems on previous projects.

##### C. Planning Report:

1. Submit Planning Report as detailed in Part 3-EXECUTION of this Section to demonstrate to Engineer and Owner that proper procedures are being followed. Planning Report shall be submitted after Quality Assurance submittal and 30 days before fieldwork starts.

##### D. Initial Test Report:

1. Prior to starting Final Balance Phase, submit Initial Test Report as detailed in Part 3 of this Section to indicate to A/E and Contractor incomplete work or problem areas to be resolved before final balance is completed.

E. Final Report:

1. Within 30 days after fieldwork is completed, submit Final Report as detailed in Part 3 of this Section to assure design objectives are met and to assist Owner in future maintenance.

## 1.05 REFERENCE STANDARDS

- A. Refer to the latest publications of the NEBB, the American Society of Plumbing Engineers (ASPE) and the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) for establishing required procedures.

## PART 2 PRODUCTS

### 2.01 INSTRUMENTATION

- A. Provide required instrumentation to obtain proper measurements. Application of instruments and accuracy of instruments and measurements shall be in accordance with requirements of NEBB or AABC Standards and instrument manufacturer's specifications.
- B. Instruments used for measurements shall be accurate, and calibration histories for each instrument shall be available for examination by Architect/Engineer upon request. Calibration and maintenance of all instruments to be in accordance with requirements of NEBB or AABC Standards.

## PART 3 EXECUTION

### 3.01 GENERAL

- A. TAB work shall be done in separate phases as outlined herein. Project schedule shall allow ample time to complete TAB work before occupancy. Follow procedures outlined herein and as described in Planning Phase narratives.
- B. Set point for individual branch balancing valves in domestic hot water return systems shall be 0.5 gpm unless otherwise noted on drawings or schedules.

### 3.02 PLANNING PHASE

A. Procedure:

1. Obtain latest contract documents including addenda and change orders. Obtain shop drawings and performance curves from Contractor for pumps, flow measuring devices, and terminal devices. Prepare Planning Report as detailed herein. Make adjustments in Planning Report and/or measuring instrument calibration.

B. Planning Report:

1. Planning Report shall contain the following minimum requirements.
  - a. Narratives:
    - 1). Provide written narratives of procedures used. Provide separate narratives for each pump and liquid fluid handling system.
    - 2). Identify flow-measuring devices to be used at each pump and terminal device. Provide different narratives for constant and variable flow systems.

- 3). For non-standard water systems, include narratives on how to measure and adjust for different viscosities.
- 4). Narratives shall include references to published standards of NEBB or AABC. Narratives shall include measuring instruments to be used and ranges required for each procedure. Narratives shall include specified adjustment tolerances. For this Project, minimum acceptable is  $\pm 10\%$  of design flow.
- b. Prebalance Checklist: include, but not limited to:
  - 1). Check for completeness or work
  - 2). System cleaning
  - 3). System fill and air venting
  - 4). Place system into operation
  - 5). Check expansion tanks and fill pressures
  - 6). Pump bearings, alignment, starters, vibration isolators, rotation
  - 7). Setting valves to proper position including shutoff and bypass valves
  - 8). Set up of controls and control devices
- c. Measuring Instrument List: list measuring instruments to be used for each procedure. Indicate ranges required for each procedure. Provide data on each measuring instrument to be used. This data shall include:
  - 1). Manufacturer name and model number
  - 2). Measurement range
  - 3). Pressure/temperature limits
  - 4). Date put into service
  - 5). Date of last calibration
  - 6). Include certificate from calibration firm
2. Architect/Engineer reserves the right to request adjustments in any procedure and/or ask for recalibration of any measuring instrument, which has not been recalibrated within the past year.
3. Samples: Submit copies of TAB forms to be used.
4. Branch circuit and terminal measurements: indicate on pre-printed forms of AABC or NEBB measurements to be taken in the field. Include branch circuit or terminal identification, system, space served, location, design flows (include zone and system summaries), and flow measuring device size, type, Cv, and manufacturer. Indicate initial setpoint on forms.

### 3.03 SET-UP PHASE

- A. Procedure:
  1. Perform prebalance checkout as per Planning Phase narrative.
- B. Initial Test:
  1. Measure pump data and flows in "as found" condition after initial valve settings are made.
- C. Initial Test Report:
  1. Submit report to Architect/Engineer and Contractor indicating measurements made and make notes of items, which are not complete or are not within design tolerance.

### 3.04 FINAL BALANCE PHASE

- A. Procedure:

1. Perform procedures as per Planning Phase narrative. Correct deficiencies and redo procedures as required before submitting Final Report.
- B. Final Report:
1. Submit report to Engineer and to Contractor indicating data and measurements as per requirements herein and per Planning Phase narrative. Do not submit partial or incomplete reports.
- C. Final Report Adjustments:
1. Architect/Engineer reserves the right to check any measurement made and to reject any portion of work not within the design tolerance of  $\pm 10\%$  of design flow. Contractor shall resubmit all or portions of Final Report as directed by Engineer.

END OF SECTION



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## SECTION 22 11 18 - WATER DISTRIBUTION SYSTEM

### PART 1 GENERAL

#### 1.01 DESCRIPTION

- A. This Section covers interior domestic cold water, domestic hot water (**120°F**), domestic hot water return, tempered water, nonpotable cold water and trap filler lines to a point 5 ft outside building wall.
- B. All components shall comply with NSF-61 and NSF-372 to be compliant with requirement for lead content of  $\leq 0.25\%$  maximum weighted average.

#### 1.02 RELATED WORK

- A. Section 20 0529 - Piping and Equipment Supporting Devices
- B. Section 20 0553 - Mechanical Systems Identification
- C. Section 20 0700 - Mechanical Systems Insulation
- D. Section 22 0594 - Domestic Water Systems Balance
- E. Section 22 2114 - Plumbing Specialties

#### 1.03 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

#### 1.04 QUALITY ASSURANCE

- A. Order pipe with each length marked with manufacturer's name or trademark and type of pipe; with each shipping unit marked with purchase order number, metal or alloy designation, temper, size, and supplier's name.
- B. Installed material not meeting specification requirements must be replaced with material that meets these Specifications without additional cost to Owner.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Promptly inspect shipments to ensure material is undamaged and complies with specifications.
- B. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends from damage. End caps shall remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.
- C. Offsite storage agreements will not relieve Contractor from using proper storage techniques.
- D. Storage and protection methods must allow inspection to verify products.
- E. Before shipping, piping shall be cleaned, free of rust and scale, and chemically treated to protect inside of pipe from rusting and furnished with end caps.

## 1.06 SUBMITTALS

### A. Manufacturer's technical data for the following:

1. Pipe
2. Fittings
3. Joints
4. Valves
5. Unions and Flanges

### B. Shop Drawings on items specified herein.

## PART 2 PRODUCTS

### 2.01 MATERIALS

#### A. Materials as specified shall be new unless otherwise noted.

### 2.02 PIPE, FITTINGS, AND JOINTS

#### A. Above Ground:

1. Copper (2-1/2" and Smaller):
  - a. Pipe: Copper tube, Type L, hard drawn, ASTM B88
  - b. Fittings:
    - 1). Cast copper alloy, solder joint, pressure rated, ANSI B16.18
    - 2). Wrought copper, solder joint, pressure rated, ANSI B16.22
  - c. Joints:
    - 1). Lead free (<0.2%) solder, ASTM B32, flux, ASTM B813
  - d. Nipples: Red brass pipe, threaded

### 2.03 UNIONS AND FLANGES

#### A. General:

1. Unions, flanges and gasket materials to have pressure rating of not less than 150 psig at 180°F.

#### B. Copper (3" and Smaller):

1. Wrought copper union, Nibco Figure 633-W. Mueller Brass equal.

### 2.04 VALVES

#### A. Shutoff Valves:

1. Ball Valves (3" and smaller):
  - a. Acceptable manufacturers: Apollo, Hammond, Milwaukee, Nibco, Stockham and Watts with indicated features and equal to model listed. Note that not all manufacturers make all sizes.
  - b. Full Port, 2 Piece: Bronze body, ASTM B584, stainless steel ball and stem, teflon seats, stem extension with length according to installed system insulation thickness, 600 psi CWP pressure rating, Nibco 585-66-LF

- c. Full Port, 3 Piece: Bronze body, ASTM B584, stainless steel ball and stem, teflon seats, stem extension with length according to installed system insulation thickness, 600 psi CWP pressure rating, Nibco 595-Y-LF]
- d. Insulated Handle: For insulated systems to prevent condensation on valve body with thermal and vapor seal, equal to Nibco Nib Seal.
2. Butterfly Valves (4" and larger):
  - a. Acceptable Manufacturers: Apollo, Hammond, Kitz, Milwaukee, Nibco, and Stockham with indicated features and equal to model listed. Note that not all manufacturers make all sizes or styles.
  - b. Threaded or Solder Ends: Bronze body, stainless steel disc and stem, viton disk seal, Milwaukee Series BB2
  - c. Lug Type: Ductile iron body, 316 stainless steel disc mounted without pins or bolts, EPDM liner, stainless steel stem, copper or glass reinforced epoxy resin bushings (lower, upper and collar), 200 psi CWP pressure rating, 10 position lever handle through 6", gear operator 8" and larger, Nibco LD-2012
  - d. Wafer Type: Ductile iron body, 316 stainless steel disc mounted without pins or bolts, EPDM liner, stainless steel stem, copper or glass reinforced epoxy resin bushings (lower, upper and collar), 200 psi CWP pressure rating, 10 position lever handle through 6", gear operator 8" and larger, Nibco WD-3222
3. Gate Valves:
  - a. Acceptable Manufacturers: Apollo, Crane, Hammond, Kennedy, Milwaukee, Nibco, and Stockham with indicated features and equal to model listed. Note that not all manufacturers make all sizes.
  - b. Size 2-1/2" and Smaller: Lead-free bronze body, bronze trim, 150 psi steam pressure rating, union bonnet, rising stem, Nibco T or S-113-LF.
  - c. Size 3" and Larger: Nickel iron body and wedge, stainless steel trim, outside screw and yoke (OS&Y), 125 psi steam pressure rating, bolted bonnet, flanged pipe ends, Nibco F-617-13
- B. Swing Check Valves:
  1. Size 2" and Smaller:
    - a. Bronze body, ASTM B62, Y pattern, Buna-N resilient disc, horizontal swing, 200 psi CWP rating, Nibco 413-Y-LF
  2. Valves 2-1/2" and Larger:
    - a. Nickel iron body, horizontal swing, stainless steel or nickel iron disc, stainless steel replaceable seat, 200 psi CWP rating, Nibco F-918-13
- C. Spring Check Valves:
  1. Valves 2" and Smaller:
    - a. Bronze body, ASTM B584, in-line lift type with spring, Buna-N or PTFE disc, 250 psi CWP rating, **Nibco 480-Y-LF**
- D. Balancing Valves:
  1. Furnish and install CircuitSolver® as indicated on the plans. CircuitSolver® shall be self-contained and fully automatic without additional piping or control mechanisms. Valve shall be a CircuitSolver® as manufactured by ThermOmegaTech®, Inc. CircuitSolver® shall regulate the flow of recirculated domestic hot water based on water temperature entering the valve regardless of system operating pressure. As the water temperature increases the valve proportionally closes dynamically adjusting flow to meet the specified temperature. CircuitSolver® body and all internal components shall be constructed of stainless steel with

major components constructed of type 303 stainless steel. CircuitSolver® shall be rated to 200 PSIG maximum working pressure and 250°F (121°C) maximum working temperature. The thermal actuator inside the valve shall be spring loaded and self cleaning, delivering closing thrust sufficient to keep orifice opening free of scale deposits. All CircuitSolver® valve are NSF-61 certified for use in all domestic water systems.

E. Mixing Valves

1. MV-1 Thermostatic Central Tempered Water Mixing Valve
  - a. Acceptable manufacturers: Lawler, Leonard, Powers or approved equal
  - b. Master emergency fixture thermostatic mixing valve, capable of maintaining mixed water temperature within 5°F of setpoint. Valve shall fail to cold water supply only on loss of hot water supply. Valve shall fail closed on loss of cold water supply.
  - c. Mixing valve shall be bronze construction with dual thermostatic elements, high temperature limit stop, locked temperature regulator and integral thermometers on inlet, outlet and mixed water lines. Valve shall be rated for 125 psig operating pressure and be certified per ANSI Z358.1 requirements.
  - d. Valve shall have **120°F** hot water inlet, **65°F** cold water inlet and 85°F mixed water temperature with peak mixed water flow of 4gpm. Leonard TA-300 LF or equal.

2.05 DIELECTRIC FITTINGS

- A. Insulating nipple, metal casing, inert thermoplastic lining; Anvil Figure 7090, Clearflow dielectric fitting by Perfection Corporation or Victaulic Style 47.
- B. Dielectric unions 2" and smaller; dielectric flanges 2-1/2" and larger; with iron female pipe thread to copper solder joint or brass female pipe thread end connections, non-asbestos gaskets and pressure rating of not less than 175 psig at 180°F. Watts Regulator Company, Lochinvar, Wilkins or Epco Sales, Inc.
- C. Copper-silicon casting, UNS C87850, threaded or grooved end. UL classified in accordance with NSF-61 for potable water service. Victaulic Style 647

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install pipe and fittings in accordance with reference standards, manufacturer's recommendations and recognized industry practices.
- B. Maintain piping system in clean condition during installation. Remove dirt and debris from assembly of piping as work progresses. Cap open pipe ends where left unattended or subject to contamination.
- C. Include connections to plumbing fixtures, to equipment by others, and to equipment requiring water. Provide proper backflow and back siphonage protection to safeguard potable water system from contamination.
- D. Lay out water system so as to conform to intent of drawings. Coordinate piping with building features and work of other trades. Install water piping plumb and square with building. Plans indicate, general routing, provide additional offsets as required. Install piping with necessary swing joints and offsets to allow for expansion.
- E. Install shut-off valves on branch lines near mains to avoid long dead-leg branches when valves are closed.

- F. Install shut-off valves where indicated and at base of risers to allow isolation of portions of system for repair.
- G. Do not install water piping within exterior walls.
- H. Provide drain valves at base of risers and at low points of trapped piping 2" and larger where trapped water volume exceeds 5 gallons.
- I. Install pressure reducing valves where indicated on drawings. Provide pressure gauges on both inlet and outlet sides of valve. Flush strainer and adjust to outlet pressure as scheduled.
- J. Provide protective sleeve covering of elastomeric pipe insulation where copper or steel piping is embedded in masonry or concrete.
- K. Provide dielectric fittings between dissimilar piping materials.
- L. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including required service space for this equipment, unless piping is serving this equipment.
- M. Install valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to equipment, fixtures and systems installed by others where same requires piping services indicated in this Section.
- N. In-line pumps 3 hp and larger shall be independently supported from building structure.
- O. Install water pipe using proper pipe and fittings. Use reducing fittings for changes in pipe size.
- P. Install trap filler lines to slope to drain tailpiece without trapping.

### 3.02 COPPER TUBING

- A. Copper tubing shall be installed per Copper Development Association guidelines in addition to methods specified herein.
- B. Soldered Copper Joints:
  - 1. Use non-acidic and lead free flux on cleaned pipe and fittings for soldered joints.
  - 2. Cut tube square, remove burrs from exterior of tube and ream interior of tube before assembly.
  - 3. Fill joints with solder by capillary action. Solder shall cover joint periphery. Wipe joint clean.
  - 4. Apply heat carefully to prevent damage to pipe, fittings and valves.
  - 5. Follow manufacturer's recommendations when heating valves and equipment for soldered connections.
- C. Brazed Copper Joints:
  - 1. Cut tube square, remove burrs from exterior of tube and ream interior of tube before assembly.
  - 2. Joints shall be cleaned and polished before brazing.
  - 3. Flux of any type shall not be used.
  - 4. Apply heat carefully to prevent damage to pipe, fittings and valves. Disassemble valves where possible to prevent damage to seats during brazing.

### 3.03 SPRING LOADED CHECK VALVES

- A. Provide spring loaded check valve in each pump discharge line.

### 3.04 DIELECTRIC UNIONS AND FLANGES

- A. Install dielectric unions or flanges at points where copper-to-steel pipe connection is required in domestic water systems.
- B. Install unions on equipment side of shutoff valves for items such as: water heaters, water softeners, pumps, filters, and similar equipment requiring periodic replacement.

### 3.05 CLEANING

- A. Flush and clean piping prior to testing. Remove corrosion by mechanical or chemical means. Use chemicals that are non-toxic.

### 3.06 TESTING

- A. Refer to Testing paragraph of Section 20 0000 - General Mechanical Requirements.
- B. Water test system may be applied to system in its entirety or in sections. Test piping with water to pressure of [100 psi] for 2 h. No decrease in pressure allowed. Provide pressure gauge with shutoff and bleeder valve at highest point of system tested. Inspect joints in system under test.
- C. Defective work or material shall be replaced or repaired as necessary and inspection and test repeated. Repairs shall be made with new materials. No caulking of threaded joints or holes will be allowed.
- D. Do not conceal pipe until satisfactorily tested.
- E. Testing with air will not be allowed.

### 3.07 BALANCING

- A. Balance water distribution system. Adjust control valves for proper operation. Set balancing valves to maintain hot water in hot water system.
- B. Balance flush valves, flow control valves and mixing valves for adequate flow and temperature to plumbing fixtures and equipment.

### 3.08 DISINFECTION

- A. Disinfect water piping in the following manner:
  - 1. Clean and flush water pipe with water until water at remote tap is clear.
  - 2. Fill water systems with solution containing 50 ppm of chlorine (minimum concentration). Allow solution to stay in water system for 24 h. Alternately use solution of 200 ppm of chlorine (minimum concentration) for 3 h.
  - 3. Flush water system of chlorine solution.
  - 4. Allow clean water to stand in system for 24 h. Take sample from remote tap for bacteriological test.
- B. Do not use water system for potable water supply until safe bacteriological test is obtained. Repeat steps 1 through 4 until safe water system is obtained.

### 3.09 BACTERIOLOGICAL TESTS

- A. Take representative water samples and test to ensure bacteriologically safe water supply system. Include HPC (Heterotrophic Plate Count) test and test for presence of *Pseudomonas aeruginosa* as well as regular coliform bacteria test. HPC test maximum containment level of 500 organisms/ml. Perform bacteriological tests shortly before Owner's acceptance of building. If tests fail, make corrections and retest.
- B. When connecting to existing water supply of unknown quality, sample for analysis and comparison with finished water system analysis shall be taken prior to making new connection. This will allow isolating source of contamination from within scope of work or pre-existing water supply. Final conditions shall meet criteria specified above for areas within scope of work.

END OF SECTION



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SECTION 22 13 14 - SANITARY WASTE AND STORM DRAINAGE SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION

- A. This Section includes materials and methods for sanitary waste and vent, clearwater waste and vent, storm drainage, and overflow storm drainage piping systems within and including piping to 5 ft outside building wall.

1.02 RELATED WORK

- A. Section 20 0700 - Mechanical Systems Insulation
- B. Section 22 2114 - Plumbing Specialties

1.03 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.04 QUALITY ASSURANCE

- A. Order piping with each length marked with manufacturer's name or trademark and type of pipe; with each shipping unit marked with purchase order number, metal or alloy designation, temper, size, and supplier's name.
- B. Installed material not meeting specification requirements must be replaced with material that meets these specifications without additional cost to Owner.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Promptly inspect shipments to insure material is undamaged and complies with Specifications.
- B. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends from damage. End caps shall remain in place. Protect fittings by storage inside or by durable, waterproof, above ground packaging.
- C. Offsite storage agreements will not relieve Contractor from using proper storage techniques.
- D. Storage and protection methods must allow inspection to verify products.

1.06 SUBMITTALS

- A. Manufacturer's technical data for the following:
  - 1. Pipe and fittings
  - 2. Joints
  - 3. Cleanouts
  - 4. Traps

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Materials herein specified shall be new, unless otherwise noted.

### 2.02 PIPE, FITTINGS, AND JOINTS

A. Interior Above Ground:

1. Cast Iron:

- a. Pipe: Hubless cast iron pipe, ASTM A-888, CISPI 301, NSF certified with material test reports from marked with collective trademark of Cast Iron Soil Pipe Institute or receive prior approval by Engineer
- b. Fittings: Hubless cast iron fittings, ASTM A-888, CISPI 301, NSF certified with material test reports from marked with collective trademark of Cast Iron Soil Pipe Institute or receive prior approval by Engineer
- c. Joints: Heavyweight no-hub couplings with stainless steel clamps, FM 1680 Class 1, ASTM C-1540, Mission Heavyweight, Husky Series 4000, Ideal Tridon "HD", or Clamp-All Hi-Torq 125

### 2.03 CLEANOUTS

- A. Josam, Mifab, Smith, Wade, Watts or Zurn, equal to number listed in Drains and Cleanout Schedule.
- B. Provide recessed, solid brass, cleanout plugs where fittings are used as cleanouts. Provide taper-thread plug with Teflon tape thread wrap.
- C. Wall Cleanouts: Cleanout with cast iron counter sunk ferrule, bronze or brass taper-thread plug, secured stainless steel access cover, equal to J.R. Smith 4472T.

### 2.04 TRAPS

- A. Same material as pipe or fittings unless specified with fixtures.

## PART 3 EXECUTION

### 3.01 INSTALLATION - GENERAL

- A. Install pipe and fittings in accordance with reference standards, manufacturer's recommendations and recognized industry practices.
- B. Connect piping to fixtures, each piece of equipment, and drains. Install required piping as shown on drawings.
- C. Grade horizontal lines with minimum of 1/8" per ft, except piping 2" diameter or smaller which shall be run at 1/4" per ft slope.
- D. Grade horizontal lines with minimum of 1/4" per ft, except piping 4" diameter or larger which may be run at 1/8" per ft slope with approval of local authority.
- E. Install piping parallel with building lines and at heights, which do not obstruct any portion of window, doorway, stairway, or passageway, except, as may be shown on plans. Install overhead piping as high as possible.

- F. Grade vent pipe for complete drainage by gravity to soil or waste pipes. Vent terminations shall be set true and level. Locate vent piping at least 10 ft away from window, door or intake openings. Coordinate closely with roofing contractor to prevent damage to roofing membrane. Flashing shall be in accordance with requirements of roofing manufacturer.
- G. Where interferences develop, offset or reroute piping as required to clear interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. Consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.
- H. Provide protective sleeve covering of elastomeric pipe insulation, where piping and/or fittings are embedded in masonry or concrete.
- I. Maintain piping in clean condition internally during construction.
- J. Mitered ells, notched tees, and orange peel reducers are not allowed. Bushings are not allowed on threaded piping.
- K. Do not route piping through transformer vaults, communications room or electrical rooms nor above transformers, panelboards, or switchboards, including required service space for this equipment, unless piping is serving this equipment.
- L. Set cleanouts true and level and protect properly throughout construction.
- M. Set floor drains true and level and protect properly throughout construction. Weep holes shall be filled with removable material and kept free from concrete and other debris during construction. Weep holes shall be cleaned out for final working order. Provide safing for floor drains installed in elevated slabs.
- N. Trap each fixture and piece of equipment requiring sanitary drainage connections. Trap seals shall be standard depth, except when deep seals are required by code. Traps shall be set true and level and located within limits of code requirements. Traps shall not be used as separator, interceptor or other type of device to retain solids. Traps shall be provided with thread type approved cleanout plugs when specified. Protect traps during construction and seal off to prevent stones, debris and other foreign matter from entering before use. Locate running traps for full accessibility with double cleanout.
- O. Provide plugs or caps for pipe openings during construction to prevent debris from entering pipe. Temporary plug shall be plastic cap or equivalent.

### 3.02 COPPER TUBING

- A. Copper tubing shall be installed per Copper Development Association guidelines in addition to methods specified herein.
- B. Soldered Copper Joints:
  - 1. Use non-acidic and lead free flux on cleaned pipe and fittings for soldered joints.
  - 2. Cut tube square, remove burrs from exterior of tube and ream interior of tube before assembly.
  - 3. Fill joints with solder by capillary action. Solder shall cover joint periphery. Wipe joint clean.
  - 4. Apply heat carefully to prevent damage to pipe, fittings and valves.
  - 5. Follow manufacturer's recommendations when heating valves and equipment for soldered connections.

### 3.03 CAST IRON PIPE

- A. No-hub Piping: Place gasket on end of one pipe or fitting and clamp assembly on end of other pipe or fitting. Firmly seat pipe or fittings ends against integrally molded shoulder inside neoprene gasket. Slide clamp assembly into position over gasket. Tighten fasteners to manufacturer's recommended torque.
- B. Install cast iron pipe and fittings as recommended by CISPI in their publication "Installation of Cast Iron Soil Pipe and Fittings".
- C. Support piping at every coupling. Locate hanger within 18" of coupling.
- D. Installations with multiple joints within a 4 ft developed length shall be supported at every second joint.
- E. Secure base of risers with thrust restraints to prevent joint separation. Restraint shall be in accordance with CISPI recommendations.
- F. Brace horizontal piping 5" and larger to prevent horizontal movement. Install bracing at every branch connection and every change of direction in accordance with CISPI recommendations.

### 3.04 TESTING

- A. Refer to Testing paragraph of Section 20 0000 - General Mechanical Requirements.
- B. Gravity Systems:
  - 1. Water test may be applied to system either in its entirety or in sections. Piping shall be tightly plugged and submitted to 10 ft head of water located at highest point. Provide separate standpipe above highest point being tested or extend system to obtain required 10 ft head of water. Head shall be maintained for at least 30 minutes before inspection starts.
- C. Defective work or material shall be replaced or repaired as necessary and inspection and test repeated. Repairs shall be made with new materials. No caulking of threaded joints or holes will be allowed.
- D. Do not backfill pipe until successfully tested.
- E. Testing with air will not be allowed.

END OF SECTION

## SECTION 22 21 14 - PLUMBING SPECIALTIES

### PART 1 GENERAL

#### 1.01 DESCRIPTION

- A. This Section covers material specialties for piping systems.
- B. All components installed on water systems defined in Section 22 1118 shall comply with NSF-372 to be compliant with requirement for lead content of <0.25% maximum weighted average.

#### 1.02 RELATED WORK

- A. Section 22 0594 - Domestic Water Systems Balance
- B. Section 22 1118 - Water Distribution System
- C. Section 22 1314 - Sanitary Waste and Storm Drainage Systems
- D. Section 22 6114 - Laboratory Compressed Air System
- E. Section 22 6214 - Laboratory Vacuum Piping System
- F. Section 22 6653 - Corrosion Resistant Waste and Vent System

#### 1.03 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

#### 1.04 SUBMITTALS

- A. Manufacturer's technical data for the following:
  - 1. Thermometers
  - 2. Pressure gauges
  - 3. Strainers
  - 4. Air vents
  - 5. In-line check valves
- B. Shop drawings on items specified herein.
- C. Certificates: Submit performance testing certificates for reduced pressure backflow preventers and double check backflow preventers.

### PART 2 PRODUCTS

#### 2.01 MATERIALS

- A. Materials herein specified shall be new unless otherwise noted.

#### 2.02 THERMOMETERS

- A. Manufacturers: Miljoco, Taylor, Trerice, Weksler, Winters and Weiss equal to Trerice number listed

- B. Thermometers shall be 9" die cast aluminum case and frame, double strength glass window, adjustable angle stem, permanently stabilized glass tube with mercury free indicating fluid, readable scale with gradations from 30°F to 240°F. Provide brass extension neck sockets of appropriate length. Terice Series No. A400 (old catalog number BX91400).
- C. Thermometers shall be 5" round bi-metal type, stainless steel case, readable scale and gradations from 30°F to 240°F, external calibrator adjustment, back or bottom connection as appropriate. Provide brass extension neck sockets of appropriate length. Terice Series No. B85200. Provide with minimum or maximum registering pointers.

### 2.03 THERMOMETER SOCKETS AND TEST WELLS

- A. Brass construction with threaded connections suitable for thermometer bulbs and control sensing devices, well length suitable for pipe diameter with extended neck as required to suit pipe insulation. Terice 5550 Series.
- B. Test wells for stainless steel piping shall be same material as piping.

### 2.04 PRESSURE GAUGES

- A. Manufacturers: Ashcroft, Marsh, Marshalltown, Miljoco, Taylor, Terice, U.S. Gauge, Weiss, and Winters, equal to Terice number listed
- B. Pressure gauge shall be 4-1/2" die cast aluminum case, double strength glass window, readable dial scale with gradations from 0 to 200 psi, phosphor bronze bourdon tube, brass socket. Provide shutoff valve with pressure gauge, Terice Series No. 600.
- C. Gauge accuracy shall meet ASME B40.1 Grade 1A (1% full scale).
- D. Pressure gauges shall be calibrated for the following pressure ranges:
  - 1. Domestic Water: 0 to 160 psi at 2 psi increments
  - 2. Laboratory Vacuum: 30" Hg at 0.2" Hg increments
- E. Pressure Snubbers:
  - 1. 1/4" or 1/2" size, matching gauge size, 1000 psig WP. Brass for copper or carbon steel pipe, stainless steel for stainless steel pipe.

### 2.05 FLEXIBLE CONNECTIONS

- A. Bronze, braided flexible hose or neoprene twinsphere connectors by Mason Industries with 150 psi WOG working pressure rating.
- B. Alternate manufacturers are Redflex, Resistoflex and Flexonics.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Provide thermometers where indicated on drawings. Thermometers shall be easily read from floor or maintenance platforms. Calibrate thermometers to insure accuracy.
- B. Install pressure gauges where indicated on drawings. Gauges shall be easily read from floor or maintenance platforms. Provide extensions as required to make gauges easily readable. Calibrate gauges to insure accuracy.

END OF SECTION



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## SECTION 22 4014 - EQUIPMENT BY OTHERS

### PART 1 GENERAL

#### 1.01 DESCRIPTION

- A. Items specified herein shall be provided by Plumbing Contractor to make equipment provided by others and Owner functional.

#### 1.02 RELATED WORK

- A. Section 22 1118 - Water Distribution System
- B. Section 22 1314 - Sanitary Waste and Vent System
- C. Section 22 1600 - Natural Gas Piping
- D. Section 22 2114 - Plumbing Specialties
- E. Section 22 6653 - Corrosion Resistant Waste and Vent System

#### 1.03 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions of Contract, Supplementary Conditions, and sections under Division 01 General Requirements.

#### 1.04 SUBMITTALS

- A. One package of manufacturer's technical data for all items. Submittal shall be assembled brochure, showing cuts and full detailed descriptions for each item.
- B. Shop drawings on items specified herein.

### PART 2 PRODUCTS

#### 2.01 MATERIALS

- A. Materials specified herein shall be new unless otherwise noted.

#### 2.02 OWNER FURNISHED / LAB EQUIPMENT

- A. Where utility services are required for equipment connection, provide the following:
  - 1. Gas utilities services shall terminate with quick connect outlet; Hanson Coupling #3-HK.
  - 2. Pressure relief device between isolation valve and quick connect on pressurized gas services; Ross L-O-X Series 15.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Plumbing Contractor shall install items specified herein as recommended by respective manufacturers. Final connections of waste, water, air, gas, etc., shall be installed by Plumbing

Contractor as directed by equipment manufacturer. Incidental items, such as, adapters and unions required to make final connection shall be provided by Plumbing Contractor.

- B. Coordinate rough-in sizes, pipe routing pathways within equipment and elevations with equipment supplier before proceeding with work.

END OF SECTION

SECTION 22 61 14 - LABORATORY COMPRESSED AIR SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

- A. This Section covers piping and equipment required to provide laboratory grade compressed air at **-40°F** dew point at 100 psi as shown on plans and details.

1.02 RELATED WORK

- A. Section 20 0529 - Piping and Equipment Supporting Devices

1.03 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.
- B. Items listed as "Cleaned for Oxygen Service" shall comply with requirements of CGA Standard G-4.1, Cleaning Equipment for Oxygen Service.

1.04 SUBMITTALS

- A. Shop drawings on items specified herein.

1.05 PRODUCT DELIVERY

- A. Deliver pipe and equipment properly packaged to protect against shipping and handling damage.
- B. Installed pipe shall be sealed during construction to prevent construction debris from entering piping system.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Materials herein specified shall be new unless otherwise noted.

2.02 PIPE AND FITTINGS

- A. Above Ground
  - 1. Copper
    - a. Pipe:
      - 1). Copper tube, Type L hard temper, cleaned and capped, ASTM B819, marked "MED" or similar in accordance with ASTM
    - b. Fittings: Wrought copper, solder joint, pressure rated, cleaned and bagged, ANSI B16.22
    - c. Joints: Brazed, silver solder, BCu-3 or BCuP-5 type, AWS A5.8, 1250°F melting point minimum.

2.03 UNIONS

- A. Copper 3" and smaller:

1. Wrought copper union, Nibco 633-W
- B. Copper 4" and larger:
  1. Cast red brass flanges, alloy 844, ASTM B584, Class 150, ANSI B16.24 with neoprene gasket

#### 2.04 VALVES

- A. Ball Valves:
  1. Acceptable manufacturers: Apollo, Nibco, Watts
  2. 3" and Smaller:
- B. Full port, 3-piece, bronze body, stainless steel ball, PTFE seats, stainless steel trim, blow-out proof stem, 6" tube extension, oxygen cleaned and bagged, quarter turn handle, 600 psi CWP; Nibco CS-595-YX-66-EC Seriethrough 2"CHECK VALVES
  1. Acceptable manufacturers: Apollo, Nibco, Watts
  2. 2" and smaller: :
    - a. Spring loaded, bronze or bronze/stainless steel body, 316 stainless steel spring, straight through flow, shipped bagged and oxygen clean. Apollo Ball-Cone Model 62-100-57.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install compressed air piping as shown on drawings and details.
- B. Provide low point drain valve at bottom of risers. Pipe mains shall not be trapped between connection at riser and last branch take-off. Branch take-offs to rooms or individual spaces shall be from top of main.
- C. Cut copper tube square and ream before assembly. Keep piping capped during construction to prevent intrusion of construction debris.
- D. Support piping drops through finished ceiling from structure above to prevent any lateral or up/down movement. Other outlet drops shall be supported from walls, columns, or workbenches using appropriate hangers, anchors, or Unistrut.
- E. Install unions on equipment side of shutoff valves for items such as: air dryers, receiver, compressors, filters, and similar equipment requiring periodic replacement or maintenance.
- F. Install vented valve for lock-out/tag-out at connection to equipment. Vented valve shall meet OSHA requirements for disabling power source and bleeding downstream energy.
- G. Install temporary plugs and caps on openings during construction phase.

#### 3.02 COPPER TUBING

- A. Copper tubing shall be installed per Copper Development Association guidelines in addition to methods specified herein.
- B. Brazed Copper Joints:
  1. Brazed joints shall be ASTM Grade 4 or 5 and have melting point at approximately 1250°F. Solder impurities shall not exceed 0.15%.
  2. Tubing shall be delivered to site with original mill caps in place.

3. Cut tube square, remove burrs from exterior of tube and ream interior of tube before assembly.
4. Joints shall be cleaned and polished before brazing.
5. Flux of any type shall not be used.
6. Apply heat carefully to prevent damage to pipe, fittings and valves. Disassemble valves where possible to prevent damage to seats during brazing.
7. Purge tube with nitrogen during brazing procedure. Provide manual shut-off valve and check valve as required for purge gas.

### 3.03 TESTING

- A. Refer to testing paragraph of Section 20 0000 - General Mechanical Requirements.
- B. Air piping shall be tested at 150 psig for 2 h prior to connection of laboratory fixtures. Soap test each joint to detect leaks during test period. No loss of pressure allowed during test period. Defective joints shall be cut out and replaced. Air piping shall be re-tested at 100 psig for 8 h after final connection of laboratory fixtures.
- C. Air compressor equipment shall be delivered pre-assembled and tested by equipment manufacturer.
- D. Verify proper signal transmission for each condition specified to Building Automation Controller.

### 3.04 CLEANING

- A. All pipe, fittings and valves will be cleaned by manufacturer. On- or off-site cleaning of any components by Contractor is not allowed. Any components, which have become contaminated, will not be used on any clean systems. They may be used in laboratory vacuum or any water system using copper pipe or fittings.
- B. Before system is placed into use, flush piping with product air to remove foreign particles.

### 3.05 WARRANTY

- A. Manufacturer shall warrant air compressor package and components complete, for period of 2 yrs from date of start-up.

END OF SECTION

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SECTION 22 62 14 - LABORATORY VACUUM PIPING SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

- A. This Section covers piping and equipment required to provide laboratory vacuum at 14” Hg to lab outlets.

1.02 RELATED WORK

- A. Section 20 0529 - Piping and Equipment Supporting Devices
- B. Section 22 2114 - Plumbing Specialties
- C. Section 22 4014 - Equipment by Others

1.03 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.04 SUBMITTALS

- A. Shop Drawings on items specified herein

1.05 PRODUCT DELIVERY

- A. Deliver pipe and equipment properly packaged to protect against shipping and handling damage.
- B. Installed pipe shall be sealed during construction to prevent construction debris from entering piping system.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Materials as specified shall be new unless otherwise noted.

2.02 PIPE AND FITTINGS

- A. Above Ground
  - 1. Copper
    - a. Pipe: Copper tube, Type L, hard temper, ASTM Specification B88
    - b. Fittings:
      - 1). Cast copper alloy, solder joint, pressure rated, ANSI B16.18
      - 2). Wrought copper or bronze, solder joint, pressure rated, ANSI B16.22
    - c. Joints: Lead free (<0.2%) solder, Bridgit or Silvabrite, ASTM B32; flux, ASTM B813

2.03 VALVES

- A. Copper Piping Systems:



1. Manufacturers: The following list of valve manufacturers is acceptable unless otherwise noted subject to providing valves equal to items specified: Nibco, Apollo and Watts
2. Size 4" and Smaller:
  - a. Ball Valves: Full port, 3-piece bronze body, quarter turn, stainless steel ball and stem, Teflon seats, blowout-proof stem, 600 psi CWP rated, screwed or soldered joint. Apollo 82-140 Series or Apollo 92-240 Series

#### 2.04 DIELECTRIC FITTINGS

##### A. Dielectric Flanges (3" and Larger)

1. Acceptable Manufacturers: Epco Sales Inc., Lochinvar, Watts, Wilkins
2. Iron female pipe thread to copper solder joint end connections, non-asbestos gaskets, pressure rating of not less than 175 psig at 180°F.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Provide low point drain valve at bottom of risers. Pipe mains shall not be trapped between connection at riser and last branch take-off. Branch take-offs to rooms or individual spaces shall be from top of main.
- B. Provide line size cleanout plug at end of corridor distribution mains for flushing out piping.

#### 3.02 PIPING SYSTEMS

- A. Piping for Laboratory Vacuum system shall be **copper**.

#### 3.03 COPPER TUBING

- A. Copper tubing shall be installed per Copper Development Association guidelines in addition to methods specified herein.
- B. Soldered Copper Joints:
  1. Use non-acidic and lead free flux on cleaned pipe and fittings for soldered joints.
  2. Cut tube square, remove burrs from exterior of tube and ream interior of tube before assembly.
  3. Fill joints with solder by capillary action. Solder shall cover joint periphery. Wipe joint clean.
  4. Apply heat carefully to prevent damage to pipe, fittings and valves.
  5. Follow manufacturer's recommendations when heating valves and equipment for soldered connections.

#### 3.04 CLEANING

- A. Before system is in use, flush piping with dry compressed air to remove foreign particles.

#### 3.05 TESTING

- A. Refer to testing paragraph of Section 20 0000 - General Mechanical Requirements.
- B. Vacuum piping shall be tested at 200 psi for 2 h prior to connection of laboratory fixtures. Soap test each joint to detect leaks during test period. No loss of pressure allowed during test period. Vacuum piping shall be re-tested at 100 psi for 8 h after final connection of laboratory fixtures.

END OF SECTION

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SECTION 23 00 00 - GENERAL HVAC REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION

- A. Specification requirements defined in Division 20 of this Specification apply to, and are in addition to the work associated with equipment, systems, materials, and installation requirements specified in Division 23. Contractor shall provide the requirements specified in Division 20 to obtain complete systems, tested, adjusted, and ready for operation.

1.02 RELATED WORK

- A. Section 20 0000 - General Mechanical Requirements
- B. Section 20 0529 - Piping and Equipment Supporting Devices
- C. Section 20 0549 - Seismic Anchorage and Restraints
- D. Section 20 0553 - Mechanical Systems Identification
- E. Section 20 0573 - Mechanical Systems Firestopping
- F. Section 20 0700 - Mechanical Systems Insulation

PART 2 PRODUCTS

2.01 NOT APPLICABLE TO THIS SECTION.

PART 3 EXECUTION

3.01 NOT APPLICABLE TO THIS SECTION.

END OF SECTION

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SECTION 23 05 95 - AIR SYSTEMS TEST ADJUST BALANCE

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 23 0901A - Control Systems
- B. Section 23 3314 - Ductwork Specialties

1.02 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.03 DESCRIPTION

- A. This Contractor shall be responsible for providing complete testing, adjusting and balancing (TAB) work for air systems, such as air handling units, return fans, exhaust fans, air terminal devices, diffusers, grilles and other air moving processes included in this project.
- B. Work required shall consist of setting volume flow rates and adjusting speed controls, recording data, making tests, and preparing reports, as specified herein.
- C. Scope of work includes TAB of new work specified herein and includes all equipment, distribution systems, and terminal units connected.
- D. Scope of work also includes TAB of existing air systems as defined by drawings, schedules, or specified in this Section.
- E. All existing air systems within scope of demolition/renovation areas shall be rebalanced as necessary to provide new air flows as indicated on drawings. This shall include measurements of existing system air flows prior to demolition and confirmation that air flows to all spaces served by systems being modified are equal to air flows that existed prior to work being started.
- F. TAB work shall be performed by persons trained in TAB work and certified by Associated Air Balance Council (AABC), National Environmental Balancing Bureau (NEBB), or Testing, Adjusting and Balancing Bureau (TABB). Procedures shall be in accordance with the latest edition of AABC, NEBB or TABB Standards, ASHRAE - 2015 HVAC Application Chapter 38, and as detailed herein.
- G. Mechanical Contractors who are members of AABC or NEBB and who have qualified personnel available to perform work may submit Quality Assurance Submittal for approval. Mechanical Contractors who cannot meet these requirements shall subcontract with independent TAB Contractor who meets these requirements. TAB subcontractor shall prepare Quality Assurance Submittal for Contractor to submit for approval.
- H. Upon direction of Architect/Engineer or TAB subcontractor, Mechanical Contractor shall provide at no additional cost to Owner, any additional work and/or devices necessary to properly balance system, including fan sheaves, motor sheaves and/or drive belts.
- I. TAB work shall not proceed until assigned personnel have been approved by Architect/Engineer via Quality Assurance Submittal. Coordinate each phase of TAB work with overall project schedule. Each phase of TAB work shall be done in timely manner as detailed herein. Fieldwork

must be completed before occupancy. Certificate of Substantial Completion shall not be issued until after Final Report is accepted by Architect/Engineer.

#### 1.04 SUBMITTALS

##### A. General:

1. Make submittals in accordance with project submittal procedure. Submit minimum of 5 copies of submittals unless more directed (3 for O&M Manuals, 1 for A/E, 1 for Contractor).
2. Reports shall be assembled using 3-ring hard cover binder with Project Name and location on cover and side panel. All information sheets shall be 8-1/2" x 11" white bond paper. Use preprinted forms of NEBB, AABC or TABB wherever possible. Provide sortable electronic version as well as hard copy. Provide numbered tabs for each system. Assemble report in the following order:
  - a. Transmittal letter
  - b. Cover sheet with Project title, location, submittal date, and name and addresses of Owner, Mechanical Contractor, TAB subcontractor, Architect, and Engineer
  - c. Index of numbered tabs listing major systems
  - d. Data organized by system in the following order:
    - 1). Equipment data and measurement summary
    - 2). Equipment measurement data
    - 3). Branch main measurement data
    - 4). Terminal device measurement data arranged by room or zone

##### B. Quality Assurance Submittal:

1. Within 30 days of signing contract, Contractor shall submit the following information:
  - a. Firm resume
    - 1). AABC or NEBB active membership certificate
    - 2). Names of 3 recent relevant completed projects along with project address, Owner's contact person, supervising design professional
  - b. Supervisor resume
  - c. Balance technician(s) resume
2. Architect/Engineer and/or Owner reserves the right to contact previous project representatives and to reject persons whom Architect/Engineer and/or Owner feel are not qualified for this project due to lack of relevant experience or problems on previous projects.

##### C. Planning Report:

1. Submit Planning Report as detailed in Part 3 of this Section to demonstrate to Architect/Engineer and Owner that proper procedures are being followed. Planning Report shall be submitted after Quality Assurance submittal and 30 days before any fieldwork starts.

##### D. Initial Test Report:

1. Prior to starting Final Balance Phase, submit Initial Test Report as detailed in Part 3 of this Section to indicate to Architect/Engineer and Contractor incomplete work or problem areas to be resolved before final balance is completed.

##### E. Final Report:

1. Within 30 days after fieldwork is completed, submit Final Report as detailed in Part 3 of this Section to assure design objectives are met and to assist Owner in future maintenance.

## 1.05 REFERENCE STANDARDS

- A. Refer to the latest publications of NEBB, AABC, TABB, ASHRAE, and Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) publications for establishing required procedures.

## PART 2 PRODUCTS

### 2.01 INSTRUMENTATION

- A. Provide all required instrumentation to obtain proper measurements. Application of instruments and accuracy of instruments and measurements shall be in accordance with requirements of NEBB, AABC or TABB Standards and instrument manufacturer's specifications.
- B. Instruments used for measurements shall be accurate, and calibration histories for each instrument to be available for examination by A/E upon request. Calibration and maintenance of instruments to be in accordance with requirements of NEBB, AABC or TABB Standards.

### 2.02 INSTRUMENT TEST HOLE PLUGS

- A. Center-pull plugs similar to CPW Series by Mocap. Plug material shall be low-density polyethylene.

## PART 3 EXECUTION

### 3.01 GENERAL

- A. TAB work shall be done in separate phases as outlined herein. TAB schedule shall allow ample time to complete TAB work before occupancy. Follow procedures outlined herein and as described in Planning Phase narratives.
- B. Unless otherwise specified, maximum acceptable offset tolerance is plus or minus 10% of the design flow rates as indicated on drawings and/or as scheduled.
- C. For spaces where supply airflow rates and exhaust airflow rates are used to maintain pressure relationships, such as lab spaces, maximum acceptable exhaust air offset shall be 0 to +10% of design flow rate offset from supply air.

### 3.02 PLANNING PHASE

- A. Procedure:
  - 1. Obtain the latest Contract Documents including addenda, applicable construction bulletins and change orders. Obtain shop drawings and performance curves from Mechanical Contractor for fans, flow measuring devices, and all terminal devices. Prepare Planning Report as detailed herein. Make adjustments in Planning Report and/or measuring instrument calibration.
- B. Planning Report:
  - 1. Planning Report shall contain the following minimum requirements.
    - a. Samples: Provide copies of all forms to be used.
    - b. General narratives: Furnish written narratives of all procedures used. Include separate narratives for each fan and air handling system. Identify flow-measuring devices to be used at each fan, air terminal device, and air outlet. Narrative shall include statement that every air outlet shall be measured and adjusted. Provide different narratives for



- constant and variable flow systems. Narratives shall include references to published standards of NEBB or AABC. Narratives shall include measuring instruments to be used and ranges required for each procedure. Narratives shall include specified adjustment tolerances.
- c. Air system narratives: Provide narratives for each air system which shall include procedures for measuring static pressures at each component of air handling system to generate a static pressure profile. Measurements shall be made to measure performance of system in all operating modes including economizer mode using 100% outside air where applicable. Differentiate between constant and variable flow systems.
  - d. Air terminal narratives: Narratives shall describe procedures for measuring flows and adjusting controls to meet specified minimum and maximum flow rates based on actual field installed conditions.
  - e. Branch duct and air outlet measurements: Indicate on preprinted forms all measurements to be taken in field. Include branch duct or air outlet identification, system, space served, location, and design flow rates (include zone and system summaries). Indicate duct or air outlet neck size, make, model number, and design velocities.
  - f. Pressure relationship test narrative: Narratives shall describe how to obtain and measure pressure relationships between spaces as per schedule or as listed below.
    - 1). Laboratories
  - g. Fume Hood Certification: Narrative shall include procedures as described in Scientific Equipment and Furniture Association (SEFA) Standard SEFA 1-2006. Each hood shall be labeled with:
    - 1). Test date
    - 2). Name of tester
    - 3). Sash position at 100 fpm and 125 fpm
    - 4). Hood Classification
  - h. Refer to fume hood specification for sash type of each hood, design exhaust rate and sash design opening size. Design airflows are based on design operating sash opening and 80 fpm face velocity at the sash opening.
2. Prebalance Checklist - to include, but not limited to:
- a. Check for completeness of work
  - b. System cleaning if required
  - c. Check fire, smoke and balancing damper positions
  - d. Place system into normal operation without economizers.
  - e. Install test openings where required.
  - f. Indicate type of test holes to be used and installation procedure.
  - g. Note condition of filters.
  - h. Provide temporary blankoffs to simulate design pressure drops of filters.
  - i. Chisel holes and duct tape are not allowed.
  - j. Wet cooling coils
  - k. Fan wheels, blades, bearings, alignment, starters, vibration isolators, and rotation
  - l. Drive belt tension and alignment
  - m. Setting of automatic dampers to proper position including shutoff and bypass dampers
  - n. For hoods and ovens indicate temperature and humidity. Correct for density changes.
  - o. Set up of controls and control devices

3. Measuring Instrument List - list what measuring instruments will be used for each procedure. Indicate ranges required for each procedure. Provide data on each measuring instrument to be used. This data shall include:
  - a. Manufacturer name and model number
  - b. Measurement range
  - c. Pressure/temperature limits
  - d. Date put into service
  - e. Date of last calibration
  - f. Include certificate from calibration firm
4. Architect/Engineer reserves the right to request adjustments in any procedure and/or ask for recalibration of any measuring instrument, which has not been recalibrated within past year.

### 3.03 SET-UP PHASE

- A. Procedure:
  1. Perform prebalance checkout as per Planning Phase narrative.
- B. Initial Test:
  1. Measure fan data and flows in "as found" condition after initial damper settings are made.
- C. Initial Test Report:
  1. Submit report to Architect/Engineer and Mechanical Contractor indicating all measurements made and make notes of all items, which are not complete or are not within design tolerance.

### 3.04 FINAL BALANCE PHASE

- A. Procedure:
  1. Perform all procedures as per Planning Phase narrative. Correct all deficiencies and redo procedures as required before submitting Final Report.
- B. Final Report:
  1. Submit report to Architect/Engineer and Mechanical Contractor indicating all data and measurements as per requirements herein and per Planning Phase narrative. Do not submit partial or incomplete reports.
- C. Final Report Adjustments:
  1. Architect/Engineer reserves the right to check any measurement made and to reject any portion of work not within required tolerance of design flow. TAB Contractor shall resubmit all or portions of Final Report as directed by Architect/Engineer.

END OF SECTION

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SECTION 23 31 14 - DUCTWORK

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 20 0529 - Piping and Equipment Supporting Devices
- B. Section 20 0549 - Seismic Anchorage and Restraints
- C. Section 20 0700 - Mechanical Systems Insulation
- D. Section 23 0550 - Vibration Isolation
- E. Section 23 0595 - Air Systems Test Adjust Balance
- F. Section 23 0902 - Control Valves and Dampers
- G. Section 23 3314 - Ductwork Specialties

1.02 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.03 SUBMITTALS

- A. For each duct system, submit schedule utilizing reinforcement tables from SMACNA HVAC Duct Construction Standards Metal and Flexible where applicable. Each duct system schedule shall include, but not be limited to, the following:
  - 1. Name of Contractor/manufacturer fabricating each duct system
  - 2. Material and gauge
  - 3. Pressure class
  - 4. Transverse joint type and length and reinforcement rigidity class with designated joint T number or proprietary duct connection if utilized for each system
  - 5. Certified test results of proprietary joint products, if used, tested in accordance with SMACNA procedures
  - 6. Intermediate reinforcement spacing and rigidity class with metal angle dimensions and gauge
  - 7. Type of longitudinal seam
  - 8. Fitting construction details
  - 9. Support methods including spacing, upper attachments, and lower attachments
  - 10. Sealant and gasket
  - 11. Sealing class
- B. Duct leakage testing methods, apparatus and apparatus certification signifying meter is in conformance with ASME Requirements for testing meters.
- C. Submit shop drawings for manufactured duct system products

- D. Submit the following information for welded sheet metal ductwork:
1. Welding Procedure Specification (WPS) for welded joints. Form to be similar to ANSI/AWS D9.1-2006 Code, Appendix "D".
  2. Procedure Qualification Record (PQR) for each WPS. Form to be similar to ANSI/AWS D9.1-2006 Code, Appendix "E".
  3. Welder and Welding Operator Qualification Test Record (satisfactory performance) for each field or shop welder. Form to be similar to ANSI/AWS D9.1-2006 Code, Appendix "F".

#### 1.04 DELIVERY, STORAGE AND HANDLING

- A. Protect duct and fittings from damage due to normal handling during shipment and storage. Protection shall be applied to ends of duct to prevent dirt and moisture from entering ducts and fittings.

#### 1.05 DESCRIPTION

- A. Furnish and erect ductwork free of objectionable vibration, chatter, and pulsations. Verify dimensions at site, making field measurements and drawings necessary for fabrication and erection.
- B. Duct sizes indicated are net inside dimensions.
- C. Where size for a duct segment is not indicated, the duct segment size shall be equal to the largest duct segment to which it is connected. Transition to smaller size shall occur on side of fitting where smaller size is indicated.

#### 1.06 DESIGN CRITERIA

- A. All products shall conform to NFPA 90A, and shall possess flame spread rating of not over 25 and smoke developed rating no higher than 50.
- B. Unless otherwise indicated, construct all ductwork of galvanized sheet metal for pressure class not less than 2" WG for positive pressure ductwork and not greater than -2" WG for negative pressure ductwork.
- C. Ductwork shall comply with Local, State and Federal requirements.
- D. Unless otherwise indicated, pressure class for VAV system supply ductwork between supply fan discharge and air terminal device inlet shall be equal to static pressure at fan discharge but not less than 4" WG; pressure class for ductwork on suction side of air handling unit and suction side of return fan shall be equal to static pressure at inlet of return fan but not less than -2" WG.
- E. Unless otherwise indicated, pressure class for fume hood exhaust ductwork between exhaust fan inlet and exhaust air terminal device outlet shall be equal to static pressure at exhaust fan inlet but not less than -4" WG.
- F. Duct transverse joints and reinforcement material, including angle ring flanges and stiffeners, shall be of same material as duct.
- G. Except as modified in this Section of specifications or on drawings, use material, weight, thickness, gauge, construction and installation methods as outlined in the following SMACNA publications:
1. HVAC Duct Construction Standards Metal and Flexible, 3<sup>rd</sup> Edition, 2005, for rectangular and round ductwork up to positive 10" WG and negative 10" WG and flat oval ductwork up to positive 10" WG.

- a. Tie rods shall be 1/2" or 3/4", galvanized steel EMT/conduits with bolt assembly consisting of rubber washer and friction anchored threaded insert similar to Ductmate Easyrod or PPI Condu-Lock.
- b. Internal tie rods are not allowed for welded ductwork and special exhaust systems, such as fume hood exhaust, BSC exhaust, animal room exhaust, BSL-3 exhaust, cagewash exhaust, shower room exhaust, kitchen hood exhaust, dishwasher exhaust, etc.

#### 1.07 WELDING REQUIREMENTS

- A. The following requirements cover arc and braze welding of nonstructural sheet metal ductwork for HVAC, architectural metal and other FDA process applications where pressures do not exceed 120" WG (positive or negative). These requirements also apply to welding of structural members whose sole purpose is stiffening, supporting, or reinforcing of sheet metal material, as well as attachment of brackets or other accessories/components required to provide complete systems.
- B. Procedure and Qualification:
  1. Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) shall be prepared by installing contractor and/or fabricator prior to execution of related work. Qualification of welding procedure shall meet or exceed requirements of the latest revision of American Welding Society, Sheet Metal Welding Code ANSI/AWS D9.1.
  2. Provide certification of satisfactory performance testing for all welders and welding operators, which provide welding services on Project.
  3. Establish and provide written quality assurance/quality control (QA/QC) procedures to ensure compliance with specification requirements. Clearly identify appropriate steps for safe welding procedures (review Appendix J of D9.1) including additional safety material, screens, eye, personnel and clothing protection, fire suppression equipment, and fume extraction equipment needed adjacent to welding work area.

### PART 2 PRODUCTS

#### 2.01 GALVANIZED STEEL SHEET

- A. Lock Former Quality (LFQ), cold rolled, open hearth soft steel sheet capable of double seaming without fracture, ASTM A924/A924M or ASTM A653/A653M. Galvanized coating shall be G90.
- B. Use G90 Galvaneal or Zinc grip where painting is specified.

#### 2.02 UNCOATED BLACK STEEL SHEET

- A. Hot or cold rolled, open hearth soft steel sheet capable of welding or double seaming without fracture, meeting ASTM A366, A568 or A569 and ANSI B32.3.

#### 2.03 ALUMINUM SHEET

- A. Aluminum alloy, ASTM B209, Type 3003H-14 capable of double seaming without fracture.

#### 2.04 STAINLESS STEEL SHEET

- A. First quality, cold rolled annealed, pickled, ASTM A240 and A480, Finish No. 2B for concealed work and Finish No. 4 for exposed work. Unless otherwise indicated, use Type 304L where welded duct construction is specified and Type 304 where non-welded duct construction is allowed.

2.05 FLEXIBLE DUCT

- A. Manufacturers: Thermaflex, or Flexmaster
- B. Factory fabricated, UL listed under UL-181 as Class 1 duct, meeting requirements of NFPA 90A with flame spread of 25 or less and smoke developed rating of 50 or under.
- C. Flexible duct shall have minimum ratings as follows:
  - 1. Operating Temperature: -20°F to 250°F
  - 2. Internal Working Pressure: Positive: 6" WG  
Negative: 1" WG
  - 3. Burst Pressure: 2-1/2 times working pressure
  - 4. Velocity: 5000 fpm
- D. Unless otherwise indicated, duct shall be nonmetallic insulated type composed of polyester film, polyethylene film, nylon film, CPE film, or coated woven fiberglass liner bonded permanently to corrosion resistant coated steel wire helix without adhesive.
- E. Insulation shall be flexible fiberglass insulation with minimum R-value of 6 at mean temperature of 75°F. Vapor barrier jacket shall be aluminum foil reinforced, polyethylene, or metalized polyester film with maximum perm rating of 0.05 permper ASTM.
- F. Insulation material shall not be exposed to air stream.
- G. Lined flexible duct shall have the following minimum acoustical performance in accordance with ARI Standard 885. Dynamic Insertion Loss in each octave band of 5 ft or 10 ft straight duct shall not be less than the following:

<u>Duct Diameter (in)</u>	<u>Dynamic Insertion Loss (dB)</u>					
	<u>Octave Band Center Frequency (Hz)</u>					
	<u>(Based on 5 ft length)</u>					
	<u>125</u>	<u>250</u>	<u>500</u>	<u>1000</u>	<u>2000</u>	<u>4000</u>
6"	6	9	18	22	24	15
8"	6	10	18	20	21	12
10"	5	11	18	18	18	9

<u>Duct Diameter (in)</u>	<u>(Based on 10 ft length)</u>					
	<u>125</u>	<u>250</u>	<u>500</u>	<u>1000</u>	<u>2000</u>	<u>4000</u>
	6"	10	15	28	33	35
8"	10	18	29	32	32	20
10"	9	19	28	31	29	18

2.06 MANUFACTURED ROUND OR FLAT OVAL DUCTWORK (POSITIVE PRESSURE)

- A. Single Wall:
  - 1. Manufacturers: Lindab, Semco or McGill AirFlow, equal to McGill AirFlow Uni-Seal duct and fittings suitable to positive 10" WG.
  - 2. Ducts shall be machine formed round and/or flat oval as shown on drawings, constructed of G90 galvanized steel. Use spiral lockseam construction. Longitudinal seam construction

may be used for ductwork over 80" diameter with minimum 16 ga. Use fittings as indicated on drawings, as specified, and as required in accordance with manufacturer's published data.

3. Unless otherwise indicated, connection shall be slip type with minimum 2" insertion length or flanged joint in accordance with manufacturer's recommendations. When flange joints are required, use Van Stone angle rings welded to duct.
4. Internal bracing is not allowed.
5. Pre-sealed snaplock pipe system "Greenseam +" as manufactured by Ductmate Industries may be used for low pressure supply air duct.

## 2.07 MANUFACTURED ROUND DUCTWORK (NEGATIVE PRESSURE)

- A. Manufacturers: McGill AirFlow Industrial duct and fittings. Semco and Lindab are acceptable manufacturers, provided meeting requirements in this Section.
- B. Ducts shall be machine formed round duct constructed of G90 galvanized steel. Use spiral lockseam construction unless otherwise indicated. Use fittings as indicated on drawings, as specified, and as required in accordance with manufacturer's published data.
- C. Connection shall use slip coupling, angle ring or Van Stone connectors in accordance with manufacturer's recommendations.
- D. Fitting gauge shall be one even gauge heavier than the lightest allowable gauge of connecting downstream section of duct.

## 2.08 DUCT SEALANTS AND GASKETS

- A. Sealant:
  1. Flexible, water based, adhesive sealant compounded specifically for sealing joints and seams in ductwork. Hardcast, McGill AirSeal, Ductmate PROseal, Mon-Eco Industries, Childers, DP1010 or H.B. Fuller/Foster.
  2. Sealants shall be UL 723 (ASTM E84) classified, and meet NFPA 90A and 90B.
  3. Sealants shall comply with requirements for LEED IEQ 4.1.
  4. Select sealants as recommended by manufacturer for specific application.
  5. Submit sealant manufacturer's data sheets including performance data, pressure ratings, surface burning characteristics data, VOC compliance with LEED IEQ 4.1, detailed installation instructions.
    - a. Sealants for exterior ductwork shall include explicit statement by manufacturer indicating suitability for application.
    - b. Sealants for exposed (uninsulated) exterior ductwork shall be UV resistant and include explicit statement by manufacturer indicating suitability for exposed exterior application.
  6. Duct tapes are not allowed.
- B. Gaskets:
  1. Butyl, copolymer or neoprene based tape similar to Ductmate 440 Gasket Tape or Neoprene Gasket Tape for flanged joints.

## 2.09 CABLE SUSPENSION SYSTEM

- A. Suspension system shall be similar to Gripple Hang-Fast as manufactured and supplied by Gripple Incorporated or Ductmate Industries "Clutcher" cable hanging system.
- B. Suspension system shall be load rated and verified by SMACNA Testing and Research Institute to be in compliance with SMACNA HVAC Duct Construction Standards, 2005, Chapter 5.



## PART 3 EXECUTION

### 3.01 GENERAL

- A. Unless otherwise indicated, install ductwork level, parallel, and/or perpendicular to building structure, walls, and ceilings and at such heights not to obstruct any portion of ceiling, window, doorway, stairway, or passageway. Install ductwork to allow adequate access and service space for equipment. Refer to drawings and/or manufacturer's recommendations. Install vertical ductwork plumb. Where interferences develop in field, offset or reroute ductwork as required to clear such interferences. In all cases, consult drawings for exact location of duct spaces, ceiling heights, door and window openings or other architectural details before installing ductwork.
- B. Make allowances for beams, pipes or other obstructions in building construction and for work of other contractors. Check plans showing work of other trades and consult with Engineer in event of interference. Transform, divide, or offset ducts as required, in such a manner as to maintain same cross sectional area of duct as indicated on drawings. Where it is necessary to install pipes or similar obstructions through ducts, consult with Engineer and obtain written approval from Engineer and Owner. If approved, provide streamlined encasement or collar designed in accordance with SMACNA Standards and seal to prevent air leakage.
- C. Ductwork shall be free of kinks and dents.
- D. Fabricate and install duct, fittings, joints, seams, reinforcement, supports, sealing, liner, etc., in sizes indicated on drawings and in accordance with manufacturer's published data and SMACNA Standards except as modified in this section of specifications or on drawings.
- E. Provide transitions where different size or different shape ductwork segments are connected. Use concentric transitions unless otherwise shown. Unless otherwise indicated, make diverging transitions with maximum angle of 15° per side (30° total diverging) and converging transitions with maximum angle of 25° per side (50° total converging).
- F. Provide transitions at ductwork system components and connections to equipment. Refer to Specification Section 23 3713 – Diffusers, Registers, and Grilles, for additional information regarding diffuser/register/grille connections.
- G. Refer to ductwork symbols list on drawings for additional and dimensional requirements for fittings.
- H. Seal duct seams and joints to meet SMACNA Class A as minimum for all ductwork including low-pressure ductwork.
- I. Construct ductwork so that interior surfaces are smooth. Internal duct hangers and internal bracing are not allowed. Refer to Part 1, Design Criteria for internal tie rods.
- J. Support coils, filters, air terminals, dampers, sound attenuator devices or other devices installed in duct systems with angles or channels, and make all connections to such equipment including equipment furnished by others. Secure frames with gaskets, nuts, bolts and washers.
- K. Air terminal devices may be supported by strap hangers if air terminal manufacturer approves. Strap hangers are not allowed for fan powered devices, double wall type and Titus Steri-Loc type devices.
- L. Where 2 different metal ducts meet, install joint in such a manner that metal ducts do not contact each other by using proper gasket seal or compound.

- M. Do not install ductwork over electrical panelboards, switchgear, switchboards or motor control centers.
- N. When original galvanized finish is altered or damaged, apply field galvanizing paint as follows:
  - 1. Prepare surface with use of power sanders or wire brushes to remove rust, paint, etc.
  - 2. Apply cold galvanizing material equal to ZRC Products, Inc.

### 3.02 ELBOWS

#### A. Rectangular Duct (SA/RA/EA):

- 1. Use radius elbows with centerline radius to width ratio of 1.5 (SMACNA Type RE 1).
- 2. Where 1.5 centerline radius elbows do not fit, use radius elbows with centerline radius to width ratio of 1.0 (SMACNA Type RE 3).
- 3. Where 1.0 centerline radius elbows do not fit, use radius elbows with centerline radius to width ratio of 0.75 (SMACNA Type RE 3) or 45° throat with radius heel elbows (SMACNA Type RE 8).
- 4. Use splitter vanes for 1.0 radius elbows, 0.75 radius elbows and 45° throat with radius heel elbows as follows;
  - a. No vanes for duct with width less than 24"
  - b. Single vane for duct with width 24" to 36"
  - c. Two vanes for duct with width over 36"
- 5. Fabricate splitter vanes in accordance with SMACNA HVAC Duct Construction Standards, Chart 4-1, (p. 4.11) and Figure 4-9 (p. 4.13).
- 6. Square throat elbows with or without turning vanes are not allowed unless specifically indicated. Square throat elbows without turning vanes may be used for transfer air ducts.

#### B. Round and Oval Duct:

- 1. Unless specific type is indicated, use radius elbows with centerline radius to diameter ratio of 1.5 regardless of duct velocity. Where 1.5 radius elbows do not fit, use 1.0 radius elbows.

### 3.03 LONGITUDINAL SEAM

#### A. Rectangular Duct:

- 1. Unless otherwise indicated, use Pittsburgh lock seam.
- 2. Seal longitudinal seams with approved sealant or pre-sealed with encapsulated mastic.
- 3. Button punch snap lock construction (SMACNA L-2) may be used for ductwork that is both 2" WG (+ or -) and lower, and 36" and smaller in width or height. For ductwork over 24" in width or height, add screw 4" from each end.
- 4. Button punch snap lock construction is not allowed for ductwork in chases and areas above inaccessible ceiling.
- 5. Button punch snap lock construction is not allowed on aluminum ductwork.

#### B. Round and Oval Duct:

- 1. Unless otherwise indicated, longitudinal seams shall be in accordance with SMACNA HVAC Duct Construction Standards with the following exceptions.
  - a. SMACNA seam types RL-3, 6A, 6B, 7 and 8 shown in Figure 3-2 are not allowed.

### 3.04 TRANSVERSE JOINT

#### A. Rectangular Duct:

1. Transverse joints shall be in accordance with SMACNA HVAC Duct Construction Standards.
2. Ductmate 25/35/45 connection systems with corner clips or optional nuts and bolts may be used. Incorporate use of all Ductmate accessories to ensure integrity of transverse connection. Install joints in strict accordance with the latest edition of Ductmate 25/35/45 Assembly and Installation Instruction Manual and Duct Construction Standards. Nexus or WDCI will be acceptable.
3. Lockformers TDC or Engles TDF may be used in accordance with T-25 flanges of SMACNA HVAC Duct Construction Standards Metal and Flexible, 2005, provided that corner pieces with bolts are used. If TDF/TDC flanges are damaged, replace the damaged joint(s) by straightening and reinforcing with minimum 1-1/2" x 1-1/2" x 1/4" angle at each side of transverse joint.

B. Round and Flat Oval Duct:

1. Unless otherwise indicated, use beaded sleeve joints (SMACNA RT-1) with minimum 2" insertion length or flange joints (SMACNA RT-2 or RT-2A).
2. Connection systems manufactured by Ductmate Industries (Spiralmate and Ovalmate) or McGill AirFlow (Uni-flange) may be used for supply air ductwork.
3. AccuFlange connected systems may be used with gaskets specified in Part 2 of this Section.

### 3.05 DUCT SUPPORTS

- A. Unless otherwise indicated, use straps or Z bar hangers with 3/8" rods to support rectangular ducts 60" wide and smaller and trapeze hangers with rods or angles to support rectangular ducts over 60" wide.
1. Use trapeze hangers to support externally insulated ductwork with weight bearing inserts. Refer to Section 20 0700 – Mechanical Systems Insulation and details.
- B. For round ducts 24" diameter or smaller, use single hanger.
1. Cable Suspension System may be used up to 24" diameter at spaces higher than 8 ft above floor or platform.
  2. Round Duct Strap Bracket by Ductmate Industries may be used up to 24" diameter.
- C. Refer to Section 20 0700 - Mechanical Systems Insulation for ductwork insulation, weight bearing inserts and insulation protection shield requirements.
- D. The following upper attachments, upper attachment devices, lower hanger attachments, hanger devices, and/or hanger attachments are not allowed except where specifically indicated:
1. Hook or loop
  2. Nailed pin fasteners
  3. Expansion nails without washers
  4. Powder actuated fasteners (forced entry anchors). Forced entry anchors may be used for upper attachments of flexible ductwork supports.
  5. Beam or "C" clamps without retaining clips or friction clamps (provide retaining clips for "C" clamps)
  6. Non-factory manufactured upper attachments for metal pan deck including wire coil and double circle (Items 16 and 17 of Fig 5-4 of SMACNA HVAC Duct Construction Standards 2005)
  7. Wire hanger
  8. Trapeze hangers supported by wires or straps
  9. Rods, straps or welded studs directly attached to metal deck
  10. Drilled hole with attachment to structural steel

11. Lag screw expansion anchor
12. Rivets
13. Non-metallic hangers or straps

- E. Supporting devices shall be standard products of manufacturers having published load ratings.
- F. Refer to Section 20 0529 - Piping and Equipment Supporting Devices for additional support requirements including attachments to structures.
- G. For welded ducts, soldered ducts or ducts with water tight joints, do not use supports utilizing screws or other penetrations into ductwork.

### 3.06 SHEET METAL WELDING

- A. Welded ductwork shall be butt-welded unless otherwise indicated. Backing material and slip joints are not allowed.
- B. Attach welding cable leads directly to base metal to be welded. Do not jumper welding cable leads through building structure, to avoid emission of stray voltage/current through building structure.
- C. Welds on exposed ductwork in occupied spaces shall be brush polished with stainless steel brush.
- D. Welds at exterior of building shall be ground smooth and brush polished with stainless steel brush to prevent atmospheric contamination and rust formation.

### 3.07 PROTECTION OF DUCTWORK

- A. Protect ductwork during construction against entry of foreign matter and construction dirt.
- B. Keep ductwork capped when work is complete for the day or when duct is not being worked on or added to. Use of polyvinyl (VISQUEEN) with duct tape wrap is an adequate measure as long as it is secure with no openings or tears in product.
- C. If ductwork is not protected, remove dirt and foreign matter from the duct system and obtain inspection and approval from Engineer upon completion of cleaning before operating fans.
- D. Return fans are not allowed to operate during construction to avoid intake of construction dirt/dust into return air ductwork.

### 3.08 LOW PRESSURE DUCT CONSTRUCTION (PRESSURE CLASS 2" WG AND UNDER)

- A. Use welds, rivets or nuts, and bolts for fabricating ductwork. Fully threaded sheet metal screws may be used on duct hangers, transverse joints and other SMACNA approved locations if screw does not extend more than 1/2" into duct. Sheet metal "TEK" screws 3/4" in length may be used as fasteners in conjunction with factory made transverse joints.
- B. Unless otherwise indicated, construct branch take-off fittings as follows:
  1. For branch take-offs including branch ducts serving more than one diffuser or grille, use 45° entry fittings. For supply air ducts, conical taps may be used.
  2. For take-offs serving single diffuser, register or grille, use straight spin-in collars with manual balancing dampers.
- C. Splitter dampers and/or extractors are not allowed.

### 3.09 HIGH PRESSURE DUCT CONSTRUCTION (GREATER THAN PRESSURE CLASS 2" WG)

- A. Use manufactured ductwork or contractor fabricated ductwork meeting specified Construction Standards and fitting performance.
- B. Submit construction details including materials, type of service, reinforcing methods, and sealing procedures.
- C. Use elbows, tees, laterals, crosses and accessory fittings as shown on drawings and as required to fabricate duct system.
- D. Use conical tees for round ductwork and 45 degree entry fittings for branch take-offs from mains unless otherwise indicated.
- E. Construct high pressure ductwork for 4" WG pressure class.
- F. Install high pressure ductwork as shown on drawings from AHU to terminal device.

### 3.10 FLEXIBLE DUCT

- A. Install flexible ducts in accordance with manufacturer's installation instructions and SMACNA Standards, except as modified in this Section of Specifications.
- B. In supply air systems with air terminal devices, flexible ducts shall be used for duct connections to diffusers, grilles, and registers for sound attenuation purposes, except above non-accessible ceilings. Flexible ducts shall be 6 ft long.
- C. In general exhaust air systems with air terminal devices, flexible ducts shall be used for duct connections to grilles and registers for sound attenuation purposed, except above non-accessible ceilings. Flexible ducts shall be minimum 6 ft long and maximum 8 ft long.
- D. Centerline radius of bends shall not be less than one duct diameters. FlexFlow Elbow supports by Thermaflex or similar products shall be used at diffuser/grille connection to assure full radius elbow.
- E. Support flexible ductwork as recommended by manufacturer and with minimum 0.5" wide saddles with maximum sag of 0.5" per ft between supports. Spacing of supports shall beat a maximum of 5 ft on center , with no portion lying on ceiling supporting system.
- F. Individual sections of flexible ductwork shall be of one-piece construction. Splicing of short sections is not allowed.
- G. Connect flexible duct liner to collars and rigid duct with stainless steel draw bands. If collars have beads, position draw bands behind beads.
- H. Pull insulation and vapor barrier jacket over liner connection and secure with draw band. For terminations at externally insulated ductwork, fittings, grilles, diffusers, etc., secure flexible duct jacket to ductwork insulation jacket with compatible vapor barrier tape.
- I. Flexible ducts are not allowed above non-accessible ceilings.
- J. Flexible ducts are not allowed in high pressure ductwork.
- K. Flexible ducts are not allowed for special exhaust systems, such as fume hood exhaust, BSC exhaust, animal room exhaust, BSL-3 exhaust, cagewash exhaust, shower room exhaust, kitchen hood exhaust, dishwasher exhaust, etc.

- L. Flexible ducts are not allowed to pass through any partition, wall, floor or ceiling.
- M. Use non-insulated high temperature type for ductwork related to solar collector system.

### 3.11 FUME EXHAUST DUCT CONSTRUCTION

#### A. General:

- 1. Construct elbows with centerline radius to width or diameter ratio of at least 1.5 and 45° lateral branch take-offs from mains.

#### B. Duct pressure class to be as follows:

- 1. From fume hood or biosafety cabinet to exhaust air terminal -2" WG
- 2. From general exhaust air grille to exhaust air terminal -2" WG
- 3. From exhaust air terminal to exhaust main or branch main -4" WG
- 4. Exhaust mains to vertical risers -4" WG
- 5. Vertical risers -4" WG
- 6. From exhaust fan to exhaust stack +2" WG

#### C. Stainless Steel Ducts:

- 1. Use 18 ga or heavier 316 stainless steel sheet with all joints and seams butt-welded airtight.
- 2. Use longitudinal seam construction with seam at top on horizontal runs. Spiral seams are not allowed on round duct.

### 3.12 FUME EXHAUST STACKS

- A. Construct stacks of no lighter than 10 ga 304 stainless steel sheet. Butt-weld all joints.
- B. Construct stacks of sufficient strength so top of stack will not deflect more than 1/2" under horizontal wind pressure determined in accordance with IBC over surface area of stack.
- C. Provide 3 guy wires connected to stack with stainless steel ring located 1/3 of stack height from top of stack anchored back to building structure.

END OF SECTION

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## SECTION 23 33 14 - DUCTWORK SPECIALTIES

### PART 1 GENERAL

#### 1.01 RELATED WORK

- A. Section 23 0595 - Air Systems Test Adjust Balance
- B. Section 23 0902 - Control Valves and Dampers (Control and Smoke Dampers)

#### 1.02 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

#### 1.03 SUBMITTALS

- A. Shop Drawings including, but not limited to, the following:
  - 1. Manufacturer's name and model number
  - 2. Capacities
  - 3. Temperature/pressure ratings
  - 4. Materials of construction
  - 5. Dimensions
  - 6. Manufacturer's installation instructions and/or detailed drawings
  - 7. All other appropriate data

#### 1.04 DESIGN CRITERIA

- A. Products and materials shall conform to NFPA Section 90A, possessing flame spread rating of not over 25 and smoke developed rating no higher than 50.
- B. Ductwork specialties exposed to air stream, such as dampers, turning vanes and access doors, shall be of same material as duct or unit at where the specialties are mounted, unless otherwise noted.
- C. Unless otherwise noted, ductwork specialties shall be designed and constructed for pressure class of ductwork in which they are installed.

### PART 2 PRODUCTS

#### 2.01 MANUAL BALANCING DAMPERS

- A. Manufacturers: Ruskin, Greenheck, Vent Products, Pottorff or Air Balance, constructed in accordance with SMACNA HVAC Duct Construction Standards, except as modified below.
- B. Rectangular Dampers:
  - 1. For low pressure ductwork, for damper blade height up to 12", use single blade type with minimum 22 ga galvanized steel blade with minimum 3/8" rod for blade width up to 18", and with minimum 18 ga galvanized steel blade with minimum 1/2" continuous rod for blade width from 19" to 48". For damper blade height more than 12", use multiple blade type with minimum 16 ga galvanized steel channel frames, opposed blade linkage operation, with blades minimum 16 ga and 6" to 8" maximum blade width, minimum 1/2" continuous rod and



1/2" x 1/2" galvanized steel angle blade stops. Bearings shall be nylon or molded synthetic. Construct dampers over 48" in width or height in multiple sections with mullions.

C. Single Blade Round Dampers:

1. For low pressure ductwork, damper shall have blade 24 ga, but no less than two gauges more than duct gauge. Rod shall be minimum 3/8" diameter or square continuous. Bearings shall be nylon or molded synthetic.

D. Provide damper operators with locking devices and damper position indicators. Sheet metal screws are not allowed in construction or installation of dampers. Use rivets or tack welds.

E. Dampers shall be properly stiffened and fabricated to prevent vibration, flutter or other noise.

F. Extend damper shafts through duct insulation or use elevated regulators for externally insulated ducts to accommodate specified insulation thickness.

## 2.02 SPLITTER VANES AND TURNING VANES

A. Radius Elbow Splitter Vanes (SMACNA Type RE-3):

1. Splitter vanes for radius elbows shall be constructed in accordance with SMACNA HVAC Duct Construction Standards Chart 4-1, (p. 4.11) and Figure 4-9 (p. 4.13).

B. Turning Vanes (SMACNA Type RE-2):

1. Turning vanes are not allowed unless specifically indicated.

## 2.03 FIRE DAMPERS

A. Manufacturers: Air Balance, NCA, Greenheck, Nailor, Cesco, Pottorff Louvers and Dampers, or Ruskin

B. Fire damper assemblies shall be listed by UL 555 with 165°F fusible link and shall meet construction standards as set forth in NFPA 90A.

C. Fire resistance rating of fire dampers shall be as shown on drawings.

D. Dampers shall be dynamic type dampers suitable for maximum air velocity and pressure to which they are subjected, but not less than 2000 fpm and 4" WG.

E. Dampers shall be curtain type with blades out of air stream when in open position. Where curtain type dampers are not available because of size, use multiple blade type dampers.

F. For round ducts, dampers similar to Ruskin Model FDR25 may be used where products are suitable for duct size, velocity and static pressure.

G. Damper fire rating shall be compatible with rating of building surface in which damper is used.

H. Submit UL installation details showing mounting method and duct connection method.

I. Where ceiling fire dampers are used, they shall be similar to Ruskin CFD(R) 2 or 3, UL Classified for installation in fire rated floor or roof/ceiling assemblies.

## PART 3 EXECUTION

### 3.01 MANUAL BALANCING DAMPERS

- A. Install manual balancing dampers in supply, return and exhaust branch ducts, as shown on drawings and as required to regulate airflow to meet air balance requirements.
- B. Install manual balancing damper in branch duct to each diffuser and grille. Install dampers as close as possible to take-offs.
- C. Install balancing dampers so as not to flutter or vibrate and as far as possible upstream from the air outlet.
- D. Do not install balancing dampers in supply ductwork upstream of air terminal devices.
- E. Balancing dampers are not required for **[return] [return and exhaust]** ductwork at outlet side of air terminal devices.
- F. Balancing damper is not required where terminal air device serves a single diffuser or grille.
- G. Do not install manual balancing dampers in the following exhaust ductwork:
  - 1. Fume hood exhaust ductwork.
  - 2. Kitchen hood exhaust ductwork.

### 3.02 SPLITTER VANES AND TURNING VANES

- A. Install splitter vanes (SMACNA Type RE-3) as shown on drawings and as specified in Section 23 3114 – Ductwork, for rectangular radius elbows. Install splitter vanes in accordance with SMACNA Standards and/or manufacturer's recommendations.
- B. Turning vanes (SMACNA Type RE-2) are not allowed unless specifically indicated.

### 3.03 FIRE DAMPERS AND COMBINATION FIRE/SMOKE DAMPERS

- A. Install dampers where shown on drawings in accordance with manufacturer's installation instructions and requirements of NFPA 90A. Install dampers complete with mounting collars, retaining angles, connections to adjoining ductwork and duct access doors. Install duct access door at each damper with door size large enough to permit replacement of fusible links and resetting of dampers.
- B. Test and demonstrate proper operation of each damper after system is installed and ready for operation.
  - 1. Manually test each damper for proper operation by removing fusible link or actuating EFL or PFL. Repair or replace any damper that does not close completely. Replace fusible link and certify in writing that each damper was installed according to manufacturer's installation instructions and that each damper can be expected to close completely when fusible link melts.
  - 2. Notify Owner and/or Owner's representative at least 48 h prior to testing to allow for witnessing.
- C. Contractor shall provide letter from manufacturer's representative indicating that dampers are installed per manufacturer's installation instructions.

END OF SECTION

SECTION 23 37 13 - DIFFUSERS, REGISTERS AND GRILLES

PART 1 GENERAL

1.01 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.02 SUBMITTALS

- A. Shop Drawings including, but not limited to, the following:
  1. Manufacturer's name and model number
  2. Identification as referenced in the Documents
  3. Capacities/ratings
  4. Materials of construction
  5. Sound ratings
  6. Dimensions
  7. Finish
  8. Color selection charts where applicable
  9. Manufacturer's installation instructions
  10. All other appropriate data

1.03 DESIGN CRITERIA

- A. Performance data shall be based on tests conducted in accordance with ASHRAE Standard 70-2006.
- B. Screw holes on surface shall be counter sunk to accept recessed type screws.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Titus, Price, Carnes, Nailor, Anemostat, Metalaire, or Krueger
- B. Acceptable manufacturers for specialty products are listed under each item.

2.02 CEILING DIFFUSERS

- A. Diffusers shall be aluminum or steel as scheduled, unless otherwise indicated, and furnished with frame type appropriate to installation. Furnish diffusers with equalizing grids where it is not possible to maintain minimum 2 times duct diameter straight duct into diffuser. Equalizing grids shall consist of individually adjustable vanes designed for equalizing airflow into diffuser neck and providing directional control of airflow.
- B. Diffuser models, sizes and finishes shall be as shown on drawings and/or as scheduled. Unless noted otherwise, diffusers shall have baked enamel or powder coat finish with color selected by Architect.

## 2.03 ARCHITECTURAL SQUARE PANEL CEILING DIFFUSERS

- A. Architectural square panel ceiling diffusers shall be similar to Titus Model OMNI diffuser.
- B. Diffusers shall have one piece 18 ga face panels. Face panel shall be removable by means of four positive locking posts. Exposed surface of face panel shall be smooth, flat, and free of visible fasteners and have rounded off corners. Face panel shall project no more than 3/8" below outside border of diffuser back pan. Back of face panel shall have an aerodynamically shaped, roller edge to ensure tight horizontal discharge pattern.
- C. Ceiling diffusers with 24" x 24" full face shall have no less than 18" x 18" face panel size.
- D. Back pan shall be one piece die-stamped and shall include integrally drawn round inlet. Diffuser back pan shall be constructed of 22 ga steel. Diffuser neck shall have minimum of 1-1/4" depth available of duct connection. Back pan shape with face panel shall deliver 360° radial horizontal air pattern.
- E. Unless otherwise indicated, diffusers shall have baked enamel or powder coat finish with color selected by Architect.

## 2.04 REGISTERS AND GRILLES

- A. Registers and grilles shall be aluminum or steel as scheduled unless otherwise indicated, and furnished with frame type appropriate to installation.
- B. Supply registers and grilles shall be double deflection type blades to provide for air deflection adjustment in all directions.
- C. Return and exhaust registers and grilles shall have fixed blade core.
- D. Registers shall be furnished complete with opposed blade volume control dampers, operable from face.
- E. Register and grille models, sizes and finishes shall be as shown on drawings and/or as scheduled. Unless noted otherwise, registers and grilles shall have baked enamel finish with color selected by Architect.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Install grilles, registers and diffusers as shown on drawings and according to manufacturer's instructions.
- B. Unless otherwise indicated, size ductwork drops to diffusers or grilles to match unit collar sizes.
- C. Seal connections between ductwork drops and diffusers/registers/grilles air tight.
- D. Support independently diffusers and grilles designed for T-bar mounting that exceed weight limit of ceiling suspension system in which they are to be installed.
- E. Unless otherwise shown, provide wire mesh screen at end of each open ended duct (OED) that is exposed in occupied spaces.
- F. Blank off unused portion of linear diffusers and grilles.

- G. Where diffusers, registers and grilles cannot be installed to avoid seeing inside duct, paint inside of duct with flat black paint to reduce visibility.
- H. Protect diffusers, registers and grilles from construction dirt. Clean or replace those soiled or stained prior to turnover to Client.

END OF SECTION

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SECTION 26 00 00 - GENERAL ELECTRICAL REQUIREMENTS

GENERAL

1.01 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

PART 1

1.02 DESCRIPTION

- A. Intent of drawings and Specifications is to obtain complete systems tested, adjusted, and ready for operation.
- B. Except as otherwise defined in greater detail, the terms "provide", "furnish" and "install" as used in Division 26 Contract Documents shall have the following meanings:
1. "Provide" or "provided" shall mean "furnish and install".
  2. "Furnish" or "furnished" does not include installation.
  3. "Install" or "installed" does not include furnishing.
- C. Include incidental details not usually shown or specified, but necessary for proper installation and operation.
- D. Check, verify and coordinate work with drawings and specifications prepared for other trades. Include modifications, relocations or adjustments necessary to complete work or to avoid interference with other trades.
- E. Included in this Contract are electrical connections to equipment provided by others. Refer to Architectural, Mechanical, Plumbing, and final shop drawings for equipment being furnished under other sections for exact locations of electrical outlets and various connections required.
- F. Information given herein and on drawings is as exact as could be secured but is not guaranteed. Do not scale drawings for dimensions.
- G. Where architectural features govern location of work, refer to Architectural Drawings.
- H. Perform work in "neat and workmanlike" manner as defined in ANSI/NECA 1, Standard Practices for Good Workmanship in Electrical Contracting.

1.03 RELATED WORK

- A. Temporary Services:
1. Division 01 - Temporary Facilities and Controls.
- B. Continuity of Service:
1. No service shall be interrupted or changed without permission from Architect and Owner. Obtain written permission before work is started.
  2. When interruption of services is required, Architect, Owner and other concerned parties shall be notified and shall determine a time.
- C. Demolition:
1. Division 02 - Selective Demolition
  2. Division 02 - Building Demolition



3. Perform required demolition to accomplish new work.
    - a. Remove abandoned wiring to source of supply.
    - b. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
    - c. Disconnect abandoned outlets and remove devices.
    - d. Remove abandoned outlets if conduit servicing them is abandoned and removed.
    - e. Provide blank cover for abandoned outlets that are not removed.
    - f. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
    - g. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
    - h. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
  4. Accomplish work in neat workmanlike manner to minimize interference; annoyance or inconvenience such work might impose on Owner or other Contractors.
  5. Unless otherwise noted, remove from premises materials and equipment removed in demolition work.
  6. Equipment noted to be removed and turned over to Owner, shall be delivered to Owner at place and time Owner designates.
  7. Where materials are to be turned over to Owner or reused and installed by Contractor, it shall be Contractor's responsibility to maintain condition of materials and equipment equal to that existing before work began. Repair or replace damaged materials or equipment at no additional cost to Owner.
  8. Where demolition work interferes with Owner's use of premises, schedule work through Architect, Owner and with other Contractors to minimize inconvenience to Owner. Architect must approve schedule before Contractor begins such work.
- D. Cleaning and Repair
1. Clean and repair existing materials and equipment that remain or are to be reused.
  2. Panelboards.
    - a. Clean exposed surfaces and check tightness of electrical connections.
    - b. Replace damaged circuit breakers and provide closure plates for vacant positions.
    - c. Provide typed circuit directory showing revised circuiting arrangement.
  3. Luminaires:
    - a. Remove existing luminaires for cleaning.
    - b. Use mild detergent to clean exterior and interior surfaces; rinse with clean water and wipe dry.
    - c. Replace lamps and broken electrical parts.
- E. Concrete Work:
1. Provide cast-in-place concrete as required by Contract Documents unless otherwise noted.
  2. Concrete shall comply with Division 03 - Concrete.
  3. Provide anchor bolts, metal shapes and templates to be cast in concrete or used to form concrete as required for anchoring and supporting electrical equipment.
- F. Painting:
1. Furnish equipment with factory-applied finish coats or paint equipment per Division 09 – Finishes unless specified otherwise.
  2. Furnish equipment with factory applied prime finish unless otherwise specified.

3. If factory finish on equipment furnished by Contractor is damaged in shipment or during construction, refinish equipment to satisfaction of Architect.
4. Furnish one can of touch up paint for each final factory-applied finish coat of product.

#### 1.04 REQUIREMENTS OF REGULATORY AGENCIES

- A. Rules and regulations of Federal, State and local authorities and utility companies, in force at time of execution of Contract shall become part of this specification.

#### 1.05 REFERENCE STANDARDS

- A. Agencies or publications referenced herein refer to the following:

1. AEIC Association of Edison Illuminating Companies
2. ANSI American National Standards Institute
3. ASME American Society of Mechanical Engineers
4. ASTM American Society for Testing and Materials
5. BICSI Building Industry Consulting Services International
6. EIA Electronic Industries Association
7. FIPS Federal Information Processing Standards
8. FCC Federal Communications Commission
9. ICEA Insulated Cable Engineers Association
10. IEEE Institute of Electrical & Electronics Engineers
11. IESNA Illuminating Engineering Society of North America
12. NEC National Electrical Code
13. NECA National Electrical Contractors Association
14. NEMA National Electrical Manufacturers Association
15. NESC National Electrical Safety Code
16. NETA National Electrical Testing Association
17. NFPA National Fire Protection Association
18. NIST National Institute of Standards & Technology
19. OSHA Occupational Safety and Health Administration
20. TIA Telecommunications Industries Association
21. UL Underwriters Laboratories, Inc.

- B. Work shall be in accordance with latest edition of codes, standards or specifications unless noted otherwise.

#### 1.06 LISTING

- A. Install materials bearing UL label or UL listing, unless UL label or listing is not available for that type of material.
- B. Other nationally recognized testing agencies, acceptable to AHJ, are approved.
- C. List of third party agencies accredited by the NCBCC to label electrical and mechanical equipment shall be obtained from the Department of Insurance, Electrical Inspection Section.

#### 1.07 ENCLOSURES

- A. Typical NEMA Enclosures and Usage

1. NEMA 1 - Indoors. Falling dirt.
2. NEMA 2 - Indoors. Falling dirt. Falling liquids. Light splashing.
3. NEMA 3 - Outdoors. Sleet, snow, rain. Windblown dust.
4. NEMA 3X - Same as NEMA 3 plus corrosion resistant.
5. NEMA 3S - Same as NEMA 3 plus mechanism operable when ice covered.
6. NEMA 3SX - Same as NEMA 3S plus corrosion resistant.
7. NEMA 3R - Outdoors. Rain, snow, sleet.
8. NEMA 3RX - Same as NEMA 3R plus corrosion resistant.
9. NEMA 4 - Indoors. Falling dirt. Falling and light splashing liquids. Flying dust, lint and fibers. Hose down.
10. NEMA 4X - Same as NEMA 4 - Indoors plus corrosion resistant.
11. NEMA 4 - Outdoors. Rain, sleet, snow. Wind blown dust. Hose down.
12. NEMA 4X - Same as NEMA 4 - Outdoors plus corrosion resistant.
13. NEMA 5 - Indoors. Falling Dirt. Falling Liquids. Settling dust, lint and fibers.
14. NEMA 6 - Indoors. Falling dirt. Falling and light splashing liquids. Flying dust, lint and fibers. Hose down. Temporary submersion.
15. NEMA 6P - Same as NEMA 6 - Indoors plus corrosion resistant. Prolonged submersion.
16. NEMA 6 - Outdoors. Rain, snow, sleet. Windblown dust. Hose down. Temporary submersion.
17. NEMA 6P - Same as NEMA 6 - Outdoors plus corrosion resistant. Prolonged Submersion.
18. NEMA 7 - Indoors. Class I, Division 1 or 2, Groups A, B, C or D. (Flammable gas).
19. NEMA 9 - Indoors. Class II, Division 1 or 2. Groups E, R, or G. (Combustible dust).
20. NEMA 12 - Indoors. Falling Dirt. Falling liquids. Flying dust, lint and fibers. Oil or coolant seepage.
21. NEMA 13 - Same as NEMA 12 plus oil or coolant spraying or splashing.

#### 1.08 SUBMITTALS

##### A. Shop Drawings (Product Data):

1. Refer to Division 01 - Submittal Procedures.
2. Note that for satisfying submittal requirements for Division 26, "Product Data" is usually more appropriate than true "Shop Drawings" as defined in Division 01. However, the expression "Shop Drawings" is generally used throughout Specification.
3. Submit shop drawings for equipment and systems as requested in respective specification sections. Submittals which are not requested may not be reviewed.
4. Specifically mark general catalog sheets and drawings to indicate specific items submitted and its correlation to specific designation for product in drawings.
5. Specifically indicate proper identification of equipment by name and/or number, as indicated in specification and shown on drawings.
6. When manufacturer's reference numbers are different from those specified, provide correct cross-reference number for each item. Clearly mark and note submittal accordingly.
7. Submit complete record of required components when luminaires, equipment and items specified include accessories, parts and additional items under one designation.
8. Include wiring diagrams for electrically powered or controlled equipment.
9. Where submittals cover products containing non-metallic materials, include "Material Safety Data Sheet" (MSDS) from manufacturer stating physical and chemical properties of components and precautionary considerations required.

10. Submit shop drawings or product data as soon as practicable after signing contracts. Submittals must be approved before installation of materials and equipment.
  11. Submittals that are not complete, not permanent, or not properly checked by Contractor, will be returned without review.
  12. Bidders shall provide a full compliance review of specifications. Compliance review shall accompany submittals. Compliance review shall include paragraph-by-paragraph review of specifications with the following information “C”, “D”, “E” marked in the margin of the specification section. Unless a deviation or exception is specifically noted in the compliance review, it is assumed that Bidder is in complete compliance with plans and specifications. Lack of these requirements in the submittal shall result in rejection of submittal. Text shall be provided accompanying compliance review as follows:
    - a. “C” – Comply with no exceptions
    - b. “D” – Comply with deviations. For each of the deviations, provide numbered footnote with reasons for proposed deviation
    - c. “E” – Exceptions; do not comply
- B. Bookmarks:
1. Submitted documents greater than 50 pages in length shall include electronic bookmarks setup to quickly navigate and easily locate submitted information. Each major series of equipment shall have a bookmark.
  2. Hyperlinks can be used to enhance bookmark tools but are not an acceptable substitute for electronic bookmarks. If hyperlinks are used, they should be clearly identifiable as a hyperlink by using a different color text similar to how MS Office identifies hyperlinks.
- C. Certificates and Inspections:
1. Obtain and pay for inspections required by authorities having jurisdiction and deliver certificates approving installations to Owner unless otherwise directed.
  2. Coordinate electrical inspections with State Construction Office inspector for Monday through Friday
  3. Deliver certificates approving installations to Owner unless otherwise directed.
- D. Operation and Maintenance Manuals:
1. Refer to Division 01 - Operation and Maintenance Data.
  2. Upon completion of work but before final acceptance of system, submit to Architect for approval, 3 copies of operation and maintenance manuals in loose-leaf binders. If "one copy" is larger than 2" thick or consists of multiple volumes, submit only one set initially for review. After securing approval, submit 3 copies to Owner.
  3. Organize manuals by specification section number and furnish table of contents and tabs for each piece of equipment or system.
  4. Manuals shall include the following:
    - a. Copies of shop drawings
    - b. Manufacturer's operating and maintenance instructions. Include parts lists of items or equipment, with component exploded views and part numbers. Where manufacturer's data includes several types or models, designate applicable type or model.
    - c. CD ROM's or flash/thumb drives of O&M data with exploded parts lists where available
    - d. Phone numbers and addresses of local parts suppliers and service companies
    - e. Internet/WEB page addresses where applicable
    - f. Wiring diagrams
    - g. Start up and shut down procedure

- h. Factory and field test records
  - i. Additional information, diagrams or explanations as designated under respective equipment or systems specification section
5. Instruct Owner's representative in operation and maintenance of equipment. Instruction shall include complete operating cycle on all apparatus.
  6. Furnish O&M manuals and instructions to Owner prior to request for final payment.
  7. Include bookmarks as indicated above.
- E. Record Documents:
1. Refer to General Conditions of Contract and Division 01 - Project Record Documents. Prepare complete set of record drawings in accordance with Division 01.
  2. Use designated set of prints of Contract Documents as prepared by Architect to mark-up for record drawing purposes.

## 1.09 JOB CONDITIONS

- A. Building Access:
1. Arrange for necessary openings in building to allow for admittance of all apparatus.
- B. Coordination:
1. Equipment provided under other Divisions of these specifications.
    - a. Motors
    - b. Electrically powered equipment
    - c. Electrically controlled equipment
    - d. Starters, where specified
    - e. Variable frequency drives, where specified
    - f. Control devices, where specified
    - g. Temperature Control wiring
  2. Provide the following devices required for control of motors or electrical equipment, unless noted otherwise:
    - a. Starters
    - b. Disconnect devices
    - c. Control devices:
      - 1). Pushbuttons
      - 2). Pilot lights
      - 3). Contacts
    - d. Conduit, boxes and wiring for Power wiring
    - e. Conduit, boxes and wiring for Control wiring, except for control wiring systems as defined in Section 23 0901.
  3. Connect and wire equipment complete and ready to operate according to wiring diagrams furnished by various trades.
  4. Wire starters or other similar control devices furnished by others.
  5. This contractor's drawings and/or specifications show number and hp rating of motors furnished by others, together with their actuating devices. Should any change in size, hp rating, voltage, or means of control be made to any motor or other electrical equipment after Contracts are awarded, Contractor responsible for change shall immediately notify this Contractor. Additional costs due to these changes shall be responsibility of Contractor initiating change.

6. Equipment and wiring shall be selected and installed for conditions in which it will be required to perform. (i.e., general purpose, weatherproof, rain tight, explosion proof, dust tight, or any other special type as required.)
  7. Comply with local utility motor starting requirements and provide starters for motors furnished by others as specified herein or under various trade sections of those specifications.
- C. Cutting and Patching:
1. Refer to General Conditions of the Contract and Division 01 - Cutting and Patching.
  2. Perform cutting and patching required for complete installation of systems, unless otherwise noted. Patch and restore work cut or damaged to original condition. This includes openings remaining from removal or relocation of existing system components.
  3. Provide materials required for patching unless otherwise noted.
  4. Do not pierce beams or columns without permission of Architect and then only as directed. If openings are required through walls or floors where no sleeve has been provided, hole shall be core drilled to avoid unnecessary damage and structural weakening.
  5. Where alterations disturb lawns, paving, walks, etc., replace, repair or refinish surfaces to condition existing prior to commencement of work. This may include areas beyond construction limits.
- D. Housekeeping and Cleanup:
1. Refer to Division 01 - Closeout Procedures.
  2. As work progresses or as directed by Architect, periodically remove waste materials from building and leave area of work broom clean. Upon completion of work, remove tools, scaffolding, broken and waste materials, etc. from site.

#### 1.10 WARRANTY

- A. Refer to Division 01 for general warranty requirements.
- B. Refer to technical sections for warranty requirement for each system.
1. Where no warranty requirements are called out, warrant for 1 year after acceptance by Owner equipment, materials, and workmanship to be free from defect.
- C. Repair, replace, or alter systems or parts of systems found defective at no extra cost to Owner.
- D. In any case, wherein fulfilling requirements of any guarantee, if this contractor disturbs any work guaranteed under another contract, this contractor shall restore such disturbed work to condition satisfactory to Architect and guarantee such restored work to same extent as it was guaranteed under such other contract.
- PART 2
- E. Warranty shall include labor, material, and travel time.

#### PRODUCTS

##### 2.01 PRODUCTS

- A. Systems and products are listed in individual specification sections which follow.

##### 2.02 PRODUCT SUBSTITUTIONS

- A. Refer to Division 01 - Product Requirements.

## EXECUTION

### 3.01 GENERAL

- PART 3
- A. Verify elevations and dimensions prior to installation of materials.
  - B. Where conduits are shown on plans, they are shown for reference only. Conduit routes shown on plans may not show all required junction boxes, pull boxes, control conduits, or coordination with other trades. Contractor is responsible for coordination of all conduit routes with other trades, and providing junction boxes and pull boxes as required by code.

### 3.02 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site under provisions of Division 01.
- B. Store and protect products under provisions of Division 01.
- C. Store in clean, dry space.
- D. Maintain factory wrapping or provide cover to protect units from dirt, water, construction debris, and traffic.
- E. Handle in accordance with manufacturer's written instructions.
- F. Handle carefully to avoid damage to components, enclosure, and finish. Lift only with lugs provided for the purpose.
- G. Provide supplemental heat if required to prevent moisture contamination. Provide temporary circuits as required.

### 3.03 FLOOR, WALL, ROOF AND CEILING OPENINGS

- A. Coordinate location of openings, chases, furred spaces, etc. with appropriate Contractors. Provide sleeves and inserts that are to be built into structure during progress of construction.
- B. Remove temporary sleeves, if used to form openings, prior to installation of permanent materials. Utilize minimum 24 ga galvanized sheet metal for permanent sleeves unless otherwise noted.
- C. Provide Schedule 40 carbon steel pipe with integral water stop for steel sleeves required below grade or to exterior.
- D. Submit to Structural Engineer for review and approval size and location of core-drilled holes prior to execution.
- E. Submit product data and installation details for penetrations of building structure. Include schedule indicating penetrating materials, (steel conduit, PVC conduit, cables, cable tray, etc.), sizes of each, opening sizes and sealant products intended for use.
- F. Where penetrations of fire-rated assemblies are involved, seal penetrations with appropriate firestopping systems as specified in Section 26 0593 - Electrical Systems Firestopping.
- G. Submit complete penetration layout drawings showing openings in building structural members including floor slabs, bearing walls, shear walls, etc. Indicate and locate, by dimension, required openings including those sleeved, formed or core drilled. Submit drawings for approval prior to preparing openings in structural member.

- H. Provide 2" clearance around penetration openings intended for raceways and cables. Where fire resistant penetrations are required, size openings in accordance with written recommendations of firestopping systems manufacturer.
- I. Seal non fire-rated floor penetrations with non-shrink grout equal to Embecco by Master Builders, or urethane caulk, as appropriate.
- J. Seal non-rated wall openings with urethane caulk.
- K. Where penetrations occur through exterior walls into building spaces, use steel sleeves with integral water stop, similar to type "WS" wall sleeves by Thunderline Corporation. Seal annular space between sleeves and pipe with "Link-Seal" modular wall and casing seals by Thunderline Corporation, or sealing system by another manufacturer approved as equal by Engineer. Sealing system shall utilize Type 316 stainless steel bolts, washers and nuts.
- L. Finish and trim penetrations as shown on details and as specified.
- M. Provide chrome or nickel plated escutcheons where raceways pass through walls, floors or ceilings and are exposed in finished areas. Size escutcheons to fit raceways for finished appearance. Finished areas shall not include mechanical/electrical rooms, janitor's closets, storage rooms, etc., unless suspended ceilings are specified.

#### 3.04 EQUIPMENT ACCESS

- A. Install raceways, cable tray, junction and pull boxes, and accessories to permit access to equipment for maintenance. Relocate raceways or accessories to provide maintenance access at no additional cost to Owner.
- B. Install equipment with sufficient maintenance space for removal, repair or changes to equipment. Provide ready accessibility to equipment and wiring without moving other future or installed equipment.
- C. Access doors in walls, chases, or inaccessible ceilings will be provided under Division 08 - Access Doors and Frames, unless otherwise indicated. Access doors for equipment shall provide access for servicing, repairs and/or maintenance.
- D. Provide necessary coordination and information to the Trade Contractor under Division 08 - Access Doors and Frames. This information shall include required locations, sizes and rough-in dimensions.
- E. Provide access doors in walls, chases or inaccessible ceilings for equipment requiring access for servicing, repairs and maintenance, unless otherwise noted. Access frames and doors shall be as manufactured by Milcor, Incorporated, or similar, of style applicable to surface. Provide access doors used in fire-rated construction with UL label. Provide steel, prime-coated access doors in dry locations. Provide stainless steel access doors for use in ceramic tile walls, toilet rooms, locker rooms, and in areas subject to excessive moisture. Provide access doors of sufficient size to allow complete maintenance. Coordinate location of access doors with General Contractor and rough-in equipment accordingly.
- F. Locate electrical outlets and equipment to fit details, panels, decorating or finish at space. Architect reserves right to make minor position changes of outlet locations before work has been installed.
- G. Verify door swings before installing room light switch boxes. Install boxes on latch side of door unless otherwise noted



### 3.05 EQUIPMENT SUPPORTS

- A. Provide supporting steel not indicated on drawings as required for installation of equipment and materials including angles, channels, beams, hangers, etc.
- B. Provide steel shell with plug type concrete anchors for attaching equipment to concrete. Plastic, rawhide or anchors using lead are not allowed.
- C. Do not support equipment or luminaires from metal roof decking.

### 3.06 SUPPORT PROTECTION

- A. In occupied areas, mechanical and electrical rooms and areas requiring normal maintenance access, guard certain equipment to protect personnel from injury.
- B. Provide minimum 1/2" thick Armstrong Armaflex insulation or similar product applied with Armstrong 520 adhesive on lower edges of equipment, including bus duct, cable tray, pull boxes and electrical supporting devices suspended less than 7 ft above floors, platforms or catwalks in these areas.
- C. Protect threaded rods or bolts at supporting elements as described above. Trim threaded rods or bolts such that they do not extend beyond supporting element.

### 3.07 ELECTRICAL SYSTEMS IDENTIFICATION

- A. Refer to Section 26 0553 – Electrical Systems Identification.

### 3.08 ACCEPTANCE TESTING

- A. When testing is to be witnessed by Architect/Engineer or Inspector, notify them at least 10 days prior to testing date.
- B. When equipment or systems fail to meet minimum test requirements, replace or repair defective work or materials as necessary and repeat inspection and test until equipment or systems meet test requirements. Make repairs with new materials.
- C. Contractor is responsible for certifying in writing equipment and system test results. Certification shall include identification of portion of system tested, date, time, test criteria and name and title of person signing test certification documents.
- D. Maintain copies of certified test results, including those for any failed tests, at project site. At completion of project, include copies of test records and certifications in O&M Manuals.

### 3.09 START-UP

- A. Systems and equipment shall be started, tested, adjusted, and turned over to Owner ready for operation. This includes "Owner-Furnished, Contractor-Installed" (OFICI) and "Contractor-Furnished, Contractor-Installed" (CFICI) systems and equipment.
- B. Follow manufacturer's pre-start-up checkout, start-up, trouble shooting and adjustment procedures.
- C. Contractor shall provide services of technician/mechanic knowledgeable in start-up and checkout of types of systems and equipment on project.
- D. Provide start-up services by manufacturer's representative where specified or where Contractor does not have qualified personnel.

- E. Coordinate start-up with all trades.

### 3.10 CLEANING

- A. Clean systems after installation is complete.
- B. Vacuum debris from panelboards, switchboards, motor starter and disconnect switch enclosures, junction boxes and pull boxes two weeks before energization and again prior to completion.
- C. Where louvers are provided in switchgear or transformer enclosures, vacuum louvers free of dust and dirt.
- D. Clean luminaire lenses and lamps at time of installation and clean lens exteriors just prior to final inspection.
- E. Thoroughly clean equipment of stains, paint spots, dirt and dust. Remove temporary labels not used for instruction or operation.

### 3.11 CONSTRUCTION WASTE MANAGEMENT

- A. Construction waste management shall be managed in accordance with provisions of Section 01 7400 Cleaning and Waste Management. Documentation shall be submitted to satisfy the requirements of that section.

END OF SECTION

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SECTION 26 05 16 - OWNER-FURNISHED EQUIPMENT

PART 1 GENERAL

1.01 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.02 DESCRIPTION

- A. Section includes electrical connection(s) to Owner-purchased pieces of equipment, which are required in construction.
- B. Owner-furnished equipment requiring work by Contractor is specified in the following Sections:
- C. Contractor shall be responsible for receipt of equipment from Owner, storage after receipt, installation, and electrical connection.
- D. Owner-furnished equipment requiring work by the Contractor is shown on the drawings and schedules.
- E. Owner-furnished, Contractor-installed equipment is labeled OFCI.

1.03 SUBMITTALS

- A. Shop Drawings: Owner-supplied shop drawings of equipment furnished by Owner.
- B. Manufacturer's Installation Instructions:
  - 1. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. Comply with NFPA 70 for components and installation.
  - 2. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store in clean, dry space. Maintain factory unopened packaging until ready for installation.

1.06 WARRANTY

- A. Refer to Division 01 and Section 26 0000 – General Electrical Requirements for general warranty requirements.
- B. Manufacturer shall provide standard 1 yr written warranty against defects in materials and workmanship for products specified in this Section. Warranty period shall begin on date of final acceptance.

## PART 2 PRODUCTS

### 2.01 (NOT APPLICABLE TO THIS SECTION)

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Provide labor, materials and electrical connections for Owner-furnished equipment in accordance with contract drawings.
- B. Install and connect Owner-furnished equipment as though it had been purchased by Contractor.
  - 1. This shall include:
    - a. Receiving equipment at jobsite
    - b. Rigging and setting equipment in place
    - c. Making electrical connections
    - d. Starting
    - e. Testing
- C. Install equipment in accordance with manufacturer's installation instructions.
- D. Verify equipment connection requirements prior to rough-in and ordering materials.
- E. Maintain equipment until facility is accepted by Owner.
- F. Review Owner-supplied shop drawings of Owner-furnished equipment to ascertain that necessary labor and materials have been provided to install equipment and complete the system it serves.

END OF SECTION

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 26 0529 - Hangers and Supports for Electrical Systems
- B. Section 26 0533 - Raceway and Boxes for Electrical Systems
- C. Section 26 0533.13 - Surface Raceway System
- D. Section 26 0553 - Electrical Systems Identification
- E. Section 26 0593 - Electrical Systems Firestopping

1.02 REFERENCE

- A. Work under this section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.03 DESCRIPTION

- A. Section includes conductors and cables rated 600 V and less, connectors, splices, and terminations rated 600 V and less, sleeves and sleeve seals for cables.
- B. Conductor and conduit sizes in these contract documents are based on copper wire, and only copper wire shall be used.

1.04 REFERENCE STANDARDS

- A. ASTM B 1 – Standard Specification for Hand-Drawn Copper Wire.
- B. ASTM B 8 – Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
- C. NEMA WC 70 – Non-Shielded Power Cable 2000 V or less for the Distribution of Electrical Energy (ICEA S-95-658).
- D. NFPA 70 – National Electrical Code.
- E. UL 44 – Thermoset-Insulated Wires and Cables.
- F. UL 83 – Thermoplastic-Insulated Wires and Cables.
- G. UL 486A-486B – Wire Connectors.
- H. UL 486C – Splicing Wire Connectors.
- I. UL 486D – Standard for Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.
- J. UL 486E – Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.
- K. UL 1569 – Standard for Metal-Clad Cables.

## 1.05 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation.
- C. Test Reports: Indicate field test and inspection procedures and interpret test results and corrective action taken for compliance with specification requirements.
- D. Closeout Submittals:
  - 1. Project Record Documents:
    - a. Record actual locations of components and circuits.
  - 2. Operation and Maintenance Data:
    - a. Include manufacturer's recommended operating instructions, maintenance procedures and intervals, and preventive maintenance instructions.

## 1.06 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. Comply with NFPA 70 for components and installation.
  - 2. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.
- B. Wire and cable boxes and reels shall bear the date of manufacture.
  - 1. Date of manufacture shall not precede contract date by more than one year.

## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in clean, dry space. Protect from dirt, fumes, water, corrosive substances, and construction debris.

## 1.08 WARRANTY

- A. Refer to Division 01 and Section 26 0000 – General Electrical Requirements for general warranty requirements.
- B. Manufacturer shall provide standard 1 yr warranty against defects in materials and workmanship for products specified in this Section. Warranty period shall begin on date of final acceptance.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. General Cable Corporation
- B. Cerrowire
- C. Southwire Company
- D. Approved equal

## 2.02 DESCRIPTION

- A. NEMA WC 70; single copper conductor insulated wire; 600 V rated insulation; 90°C maximum operating temperature for dry and wet or damp locations.
  - 1. Thermoplastic-insulated wires and cables: NEMA WC 70, UL 83; Type THW, THHN, and THWN.
  - 2. Thermoset-insulated wires and cables: NEMA WC 70, UL 44; Type XHHW and XHHW-2.
- B. Metal-clad cable, Type MC; UL 1569:
  - 1. Impervious, corrugated, continuous, seam welded metal sheath.

## 2.03 REMOTE CONTROL AND SIGNAL CIRCUITS

- A. Class 1
  - 1. Copper conductor, single insulated wire.
  - 2. Insulation type THHN rated 90°C, 600 V insulation class.
  - 3. Type XHHW for ambient temperature less than 32°F.
  - 4. UL 83 listed, ASTM B 1 for solid conductors; ASTM B 8 for stranded conductors.
- B. Classes 2 and 3
  - 1. Copper conductor, multiple twisted conductors covered with an overall non-metallic jacket unless otherwise noted.
  - 2. Insulation type XLPE, rated 105°C, 300 V insulation class.
  - 3. UL listed for use in space in which circuits will be installed.

## 2.04 CONNECTORS, SPLICES, AND TERMINALS

- A. Manufacturers:
  - 1. AFC Cable Systems, Inc.
  - 2. Hubbell Power Systems, Inc.
  - 3. O-Z/Gedney; EGS Electrical Group LLC.
  - 4. 3M; Electrical Products Division
  - 5. Tyco Electronics Corp.
  - 6. Approved equal
- B. Description: UL 486A-486B, UL 486C, UL 486D, UL 486E; factory-fabricated connectors, splices, and terminals of size, ampacity rating, material, type, and class for application and service indicated.

## 2.05 TERMINATIONS

- A. Compression set, bolted or screw type lug, or direct to bolted or screw type terminal.

## 2.06 PLASTIC CABLE TIES

- A. Nylon or approved; locking type; metallic ties not permitted.

## PART 3 EXECUTION

### 3.01 INSTALLATION OF CONDUCTORS AND CABLES

- A. Install conductors in a raceway system, unless otherwise specified or indicated.



- B. Install conductors only after:
  - 1. Building interior is enclosed and weather tight
  - 2. Mechanical work likely to damage conductors has been completed
  - 3. Raceway installation is complete and supported
- C. Pull conductors into raceway at same time.
- D. Neatly train and lace conductors inside boxes, equipment, and panelboards.
- E. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- F. 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.
- G. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- H. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible. Protect exposed cables from damage.
- I. Support cables above accessible ceiling using plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.
- J. Support cables and conductors in vertical raceways per requirements in Section 26 0529 - Hangers and Supports for Electrical Systems.
- K. Identify and color-code conductors and cables according to Section 26 0553 - Electrical Systems Identification.
- L. Wiring at Outlets: Install conductor at each outlet, with minimum 12" of slack.
- M. Limit conduit fill to a maximum of 9 current-carrying conductors.
- N. Install stranded conductors where conductors terminate in crimp type lugs. Do not place bare stranded conductors directly under screws.
- O. Install VFD input wiring, output wiring and control wiring in their own separate conduit systems.
- P. Provide dedicated neutrals for branch circuits unless otherwise noted on drawings.

### 3.02 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for #10 AWG and smaller; stranded for #8 AWG and larger.
- B. Branch Circuits: Copper. Solid for #10 AWG and smaller; stranded for #8 AWG and larger.
- C. Minimum conductor sizes shall be as follows:
  - 1. #12 AWG – Branch circuits of any kind.
  - 2. #14 AWG – Fire alarm system.
  - 3. #16 AWG – Remote control and signal systems.
- D. Branch wiring length limitations:

1. Where wire sizes are shown on project drawings and do not indicate they have been adjusted for voltage drop based on circuit length, they shall be increased as noted below depending on contractor routing.
2. 208Y/120 V circuits over 50' in length:
  - a. Minimum size #10 AWG to first outlet.
  - b. Increase wire size one size for each 100' of length. Increase conduit size as required.
3. 480Y/277 V circuits over 125' in length:
  - a. Minimum wire size #10 AWG to first outlet.
  - b. Increase wire size one size for each 150' of length. Increase conduit size as required.

### 3.03 CONDUCTOR INSULATIONS AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, rated 90°C for wet locations, single conductors in raceway.
- B. Exposed Branch Circuits, Including in Crawl Spaces: Type THHN, THWN-2, rated 90°C for dry and wet or damp locations, single conductors in raceway.
- C. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN, THWN-2, rated 90°C for dry and wet or damp locations, single conductors in raceway.
- D. Motor Circuit Branch Wiring and Associated Control Wiring: Type THHN, rated 90°C for dry and damp locations, single conductors in raceway.
- E. Motor Circuit Branch Wiring Between Motor and VFD: XHHW-2
  1. Requirements for raceway installation when VFD cable is not used:
    - a. Tighten all raceway fittings and connections per manufacturer's requirements.
    - b. Bond and secure raceways to junction boxes.
    - c. Set screw connectors are not permitted.
    - d. Install equipment grounding conductor to be continuous between supply and load.
    - e. Install fittings to provide proper 360° connection between raceway and enclosure at concentric knockouts.
    - f. Remove paint from any surfaces between bond of enclosure, fittings and raceway.
    - g. Provide grounding bushings at enclosures.
    - h. Re-torque all fittings and terminations prior to building turnover.
- F. Branch Circuits Single Conductors in Raceway: 90°C rated conductors sized at 75°C rating for connection to equipment and devices.
- G. Metal-clad cable, Type MC, use for the following:
  1. Recessed and semi-recessed lighting fixtures only. Maximum 6 feet in length, min. 1/2" diameter, Min. #12 AWG solid copper (600V), #12 AWG separate green ground wire.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

### 3.04 REMOTE CONTROL AND SIGNAL CIRCUITS

- A. Sizing – #16 AWG minimum.
- B. Installation:

1. Install cables in cable tray and cable rings.
2. Provide protection for exposed cables where subject to damage.
3. Support cables above accessible ceilings; do not rest on ceiling tiles.
4. Use suitable cable fittings and connectors.

### 3.05 CONNECTORS, SPLICES, AND TERMINALS

#### A. Connectors:

1. Except where equipment is furnished with bolted or screw type lug, use compression set pressure connectors with insulating covers. Use compression tools and die compatible with connectors being installed.
2. Use bolt or compression-set type with application of insulating tape, pre-stretched or heat-shrinkable insulating tubing for splices and taps of #8 AWG conductors and larger. Install with hydraulic compression tool.
3. Use pre-insulated "twist-on" connectors with integral spring for splices and taps of #10 AWG conductors and smaller.
4. 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. Splices:

1. Splice wires and cable only in accessible locations such as within junction boxes.
2. Make splices to carry full capacity of conductors with no perceptible temperature rise.
3. Make below-grade splices in manholes and handholes watertight with pre-stretched or heat-shrinkable insulating tubing, or resin-filled insulator.
4. Use electrical tape to build up insulation level equivalent to cable insulation and cover with not less than two half-lapped layers of plastic electrical tape, for joints, taps, and splices of #1 AWG conductors and larger.
5. Plastic snap-on splice insulators are not allowed.
6. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

#### C. Terminals:

1. Insulate ends of spare conductors with electrical tape and identify spare circuit number where appropriate.
2. Eye type crimped terminal for removable screw type terminal. Forked torque terminal when screw terminal cannot be removed.
3. Train wires to eliminate fanning of stands, crimp with proper tool and die.
4. Torque screw termination per manufacturer's recommended values.

### 3.06 CABLE TIES

- A. Neatly bundle conductors and cables together for support. Size cable ties sufficiently to accommodate the multiple cables being supported.

### 3.07 FIELD QUALITY CONTROL

- A. Inspect all wiring and connections for defects and damage. Replace conductors and cables that are found defective, at no expense to Owner.

END OF SECTION

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## SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 GENERAL

#### 1.01 RELATED WORK

- A. Section 27 1000 - Structured Cabling
- B. Section 27 1100 - Communications Equipment Room Fittings
- C. Section 27 1300 - Communications Backbone Cabling
- D. Section 27 1500 - Communications Horizontal Cabling

#### 1.02 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

#### 1.03 DESCRIPTION

- A. Section includes methods and materials for grounding systems and equipment, as required by State Codes, NFPA 70, applicable portions of other NFPA codes, as indicated herein.
- B. Maximum resistance to ground shall be less than 25 ohms.

#### 1.04 REFERENCE STANDARDS

- A. TIA-607-B – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
- B. ASTM B 3 – Specification for Soft or Annealed Copper Wire
- C. ASTM B 8 – Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft
- D. ASTM B 33 – Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes
- E. IEEE C2 – National Electrical Safety Code (ANSI)
- F. IEEE 857 – Standard for Qualifying Permanent Connections Used in Substation Grounding
- G. NETA MTS – Maintenance Testing Specifications
- H. NFPA 70 – National Electrical Code
- I. NFPA 70B – Recommended Practice for Electrical Equipment Maintenance
- J. UL 467 – Grounding and Bonding Equipment

#### 1.05 TELECOMMUNICATIONS GROUNDING SYSTEM DEFINITIONS

- A. Grounding Equalizer (GE): Conductor that interconnects elements of telecommunications grounding infrastructure.

- B. Telecommunications Bonding Backbone (TBB): Conductor that interconnects telecommunications main grounding busbar (TMGB) to telecommunications grounding busbar (TGB).
- C. Telecommunications Bonding Conductor: Conductor that interconnects telecommunications bonding infrastructure to building's service equipment (power) ground.

#### 1.06 SUBMITTALS

- A. Product Data: For each type of product indicated.

#### 1.07 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70.
  - 2. Comply with UL 467 for grounding and bonding materials and equipment.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store products in clean, dry space. Protect from dirt, fumes, water, corrosive substances, and construction debris.

#### 1.09 WARRANTY

- A. Refer to Division 01 and Section 26 0000 – General Electrical Requirements for general warranty requirements.
- B. Manufacturer shall provide standard 1 yr written warranty against defects in materials and workmanship for products specified in this Section. Warranty period shall begin on date of final acceptance.

### PART 2 PRODUCTS

#### 2.01 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction, insulation color: green.
- B. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
  - 4. Bonding Cable: 28 kcmil, 14 strands of #17 AWG conductor, 1/4" in diameter.
  - 5. Bonding Conductor: #4 AWG or #6 AWG, stranded conductor.
  - 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8" wide and 1/16" thick.
  - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8" wide and 1/16" thick.

## 2.02 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Electro-tin plated copper or copper alloy, bolted pressure-type, with at least two bolts.
  - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Compression Connectors: Irreversible type.

## 2.03 TELECOMMUNICATIONS GROUNDING CONDUCTORS

- A. Material: Stranded copper
- B. Provide insulated bonding conductors.
  - 1. Green Jacket or Black Jacket marked with Green Tape or Green adhesive labels per NEC Guidelines.

## 2.04 TELECOMMUNICATIONS GROUNDING CONNECTIONS

- A. Mechanical Connectors:
  - 1. Connector Body:
    - a. High-strength, high-conductivity cast copper alloy
    - b. 2-bolt type
  - 2. Bolts, nuts, washers, and lock-washers: 300 series stainless steel
    - a. Supplied as part of connector body
    - b. Split-bolt connector types are not allowed.
  - 3. Connector:
    - a. Meet or exceed UL 467
    - b. Clearly marked with catalog number, conductor size, and manufacturer
- B. Compression Connectors:
  - 1. Connector Body: Pure wrought copper.
  - 2. Conductivity shall be no less than 99% by IACS Standards.
  - 3. Connector:
    - a. Meet or exceed performance requirements of IEEE 837, latest revision.
    - b. Filled with an oxide-inhibiting compound.
    - c. Clearly marked with manufacturer, catalog number, conductor size, and required compression tool settings.
  - 4. Connection shall be irreversible.



## PART 3 EXECUTION

### 3.01 APPLICATIONS

- A. Conductors: Install solid conductor for #8 AWG and smaller, and stranded conductors for #6 AWG and larger, unless otherwise indicated.
- B. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors
  - 2. Connections to Structural Steel: Welded connectors
- C.

### 3.02 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with feeders and branch circuits.
  - 1. Install a single insulated equipment ground conductor for each branch circuit conduit originating from panelboards.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits
  - 2. Lighting circuits
  - 3. Receptacle circuits
  - 4. Single-phase motor and appliance branch circuits
  - 5. Three-phase motor and appliance branch circuits
  - 6. Flexible raceway runs
  - 7. Armored and metal-clad cable runs
  - 8. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- C. Air-Duct Equipment Circuits: Install a separate insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping. Ground ductwork of fans serving flammable liquid storage rooms or fume hoods. Install continuous ground around any flexible connections in this ductwork system. Bond lower end of exhaust ducts, vent stacks, etc., which pass through roof.
- D. Metallic Sleeves: Minimum #6 AWG
- E. Duplex receptacles and light switches of any amperage: Install separate jumper between grounding terminal on device and metallic box.
- F. Size of equipment grounding conductors for branch circuits: As indicated in NEC-70, except minimum size shall be #12 AWG.
- G. Signal and Communication Equipment: For alarm and other communication equipment (see Telecommunications Grounding System Installation section below for voice and data systems), install insulated grounding conductor (sized as indicated on drawings) in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
  - 1. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

H. Install grounding conductor to luminaires hanging from conduit swivel hangers.

### 3.03 SEQUENCING, SCHEDULING

A. Permanently attach service grounds before permanent building service is energized.

B. Permanently attach equipment grounds prior to energizing equipment.

### 3.04 INSTALLATION

A. Connections: Exposed and visible for inspection at all times. Do not install insulation over ground connections.

B. Identify all grounding conductors by system and room number of terminations at building grounding electrode point.

C. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned copper bonding jumper to bond across flexible duct connections to achieve continuity.

F. Make grounding connections on surface that has been cleaned of paint, dirt, oil, etc., so that connections are bare metal to bare metal contact.

G. Make grounding connections tight with UL listed grounding devices, fittings, bushings, etc.

H. Equipment Grounding Conductor: Terminate in panelboard at green wire ground bus.

I. Multiple Conductors on Single Lug: Not permitted. Terminate each grounding conductor on its own terminal lug.

J. Flexible Metallic Conduit, Non-Metallic Rigid Conduit, or Liquid Tight Flexible Conduit: Install green wire grounding conductor with phase conductors in conduit.

### 3.05 FIELD QUALITY CONTROL

A. Inspect all wiring and connections for defects and damage. Replace conductors that are found defective, at no expense to Owner.

END OF SECTION

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SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 26 0533 – Raceway and Boxes for Electrical Systems
- B. Section 26 0548 – Vibration and Seismic Controls for Electrical Systems
- C. Section 26 2816 – Enclosed Switches and Circuit Breakers
- D. Section 26 5000 – Lighting

1.02 REFERENCE

- A. Work under this section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions and sections under Division 01 General Requirements.

1.03 DESCRIPTION

- A. Section includes the following:
  - 1. Manufactured hangers and supports for individual raceways and cables, slotted channel and angle systems for multiple conduit runs, and most electrical equipment that is not floor mounted.
  - 2. Construction requirements for concrete housekeeping pads for floor-mounted electrical equipment.
  - 3. Conduit hangers for acoustical noise and vibration control.
  - 4. Equipment mounts for acoustical noise and vibration control.

1.04 REFERENCE STANDARDS

- A. AWS D1.1/D1.1M – Structural Welding Code-Steel.
- B. ASTM A 36/A 36M – Carbon Structural Steel.
- C. ASTM A 325 – Structural Bolts, Steel, Heat Treated, 827/724 MPa(120/105 ksi) Minimum Tensile Strength.
- D. ASTM A 780 – Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- E. MSS SP-58 – Pipe Hangers and Supports - Materials, Design and Manufacture.
- F. MSS SP-69 – Pipe Hangers and Supports - Selection and Application.
- G. MFMA-4 – Metal Framing Standards Publication.
- H. NECA 1 – Standard Practices for Good Workmanship in Electrical Construction.
- I. NECA 101 – Standard for Installing Steel Conduits (Rigid, IMC, EMT).
- J. NFPA 70 – National Electrical Code.

K. SSPC-PA 1 – Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel.

L. ETL PVC-001 – PVC Coated Conduit

#### 1.05 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.
2. Raceway and cable supports.
3. Support for conductors in vertical raceway.
4. Structural steel for fabricated supports and restraints.
5. Mounting, anchoring, and attachment components:
  - a. Mechanical-expansion anchors.
  - b. Concrete inserts.
  - c. Clamps for attachment to structural steel.
  - d. Through bolts.
  - e. Toggle bolts.
  - f. Hanger rods.

B. Shop Drawings: Signed and sealed by an Engineer registered and licensed in the State of North Carolina. Include concrete anchors application, size, and placement. Include concrete inserts application, size, loading, and placement. Show fabrications and installation details and include calculations for the following:

1. Trapeze hangers. Include product data for components.
2. Steel slotted channel systems. Include product data for components.

C. Drawings showing specific locations of any suspended loads which exceed 100 lbs within joist chord panel, to be attached to open web steel joist structural members. Include weight supported by such attachments. (Panel is length of chord between two adjacent diagonal web members at points of connection to chord.)

D. Welding certificates and drawings showing specific locations of any weld attachments to structure including weight supported by such attachments.

1. Any proposed weld attachments to building structure shall be reviewed by Structural Engineer prior to execution of work. This review may result in use of other welding codes or standards, which may apply to “structural work”. Execution of this work may be assigned to General Trades responsible for building structural steel. Cost of this work, however, will remain the responsibility of this Contractor.

E. Schedule of hangers and support devices with support spacing.

#### 1.06 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, “Structural Welding Code – Steel.”

B. Comply with NFPA 70.

## PART 2 PRODUCTS

### 2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of 5 times the applied force.
- B. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  - 1. Finishes
    - a. Metallic Coatings:
      - 1) Factory standard primed, galvanized or electroplated finish and applied according to MFMA-4, for indoor applications.
      - 2) Hot-dip galvanized after fabrication and applied according to MFMA-4, for outdoor applications.
    - b. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4, for corrosive environments.
    - c. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  - 2. Channel Dimensions: Selected for applicable load criteria.
  - 3. Manufacturers:
    - a. Allied Support Systems; Power-Strut Unit.
    - b. Cooper B-Line, Inc.; A division of Cooper Industries.
    - c. ERICO International Corporation.
    - d. GS Metals Corporation.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; Tyco International, Ltd.
    - g. Wesanco, Inc.
    - h. National Pipe Hanger Corporation.
    - i. Michigan Hanger Co., Inc.; O-Strut Division.
    - j. Approved equal.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Raceway and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Raceway: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Concrete Anchors

- a. Anchors shall be selected, sized, and detailed by Contractor's structural engineer registered in project's jurisdiction, based on project conditions and in accordance with project building code. Calculations and drawings shall be submitted.
- b. Anchors shall meet ICC Acceptance Criteria, and ICC-ES Evaluation Reports (ESRs) shall specifically list the current applicable codes.
- c. Anchors installed in hardened concrete for purpose of transmitting structural loads from one connected element to another, or for safety related elements such as sprinkler pipes, heavy suspended pipes, and barrier rails shall have ICC-ES report demonstrating anchors have met requirements of AC 193 for mechanical anchors in concrete elements.
- d. Post-installed expansion anchors and undercut anchors installed in hardened concrete shall be qualified for strength design and tested according to ACI 355.2. Designs shall be per the requirements of ACI 318, Appendix D.
- e. Anchors for seismic load application shall be approved by ICC-ES Evaluation Reports to resist seismic loads and selected to meet project seismic design requirements. Refer to Section 20 0549 – Seismic Anchorage and Restraints and Structural drawings.
- f. Anchors shall be zinc plated in accordance with ASTM B633.
- g. Select anchors with load ratings based on cracked concrete conditions.
- h. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
  - 1) Manufacturers:
    - a) Cooper B-Line, Inc.; A division of Cooper Industries
    - b) Empire Tool and Manufacturing Co., Inc.
    - c) Hilti Inc.
    - d) ITW Ramset/Red Head; A division of Illinois Tool Works, Inc.
    - e) MKT Fastening, LLC.
    - f) Approved equal
  2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
  3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
- H. Beam Clamps: C-clamps are allowed 3/8" or smaller and only for static loading such conduits. Provide locknut for hanging rod at clamp. C-clamps are not allowed for open web steel joist applications nor seismic applications.
- I. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
- J. Toggle Bolts: All-steel springhead type.
- K. Hanger Rods:
  1. MSS SP-58; threaded steel, with adjusting and lock nuts; electroplated zinc finish.
  2. MSS SP-58; nonmetallic, with adjusting and lock nuts.

## 2.02 CONTINUOUS INSERT CHANNELS

- A. Length and support capabilities to be suitable for application.
- B. Brackets, inserts and accessories suitable for channel insert selected.

C. Manufacturers:

1. Unistrut; Tyco International, Ltd.
2. Cooper B-Line, Inc.; A division of Cooper Industries
3. Michigan Hanger Co., O-Strut Division
4. Anvil International, Inc.
5. Approved equal

2.03 CONDUIT HANGERS FOR ACOUSTICAL NOISE AND VIBRATION CONTROL

A. Manufacturers:

1. Mason Industries, Inc. (Hauppauge, NY), Type HD.
2. Amber/Booth Co. (Houston, TX), Type BRD-A.
3. Kinetics Noise Control, Inc. (Dublin, OH), Type RH or FH.
4. Vibration Eliminator Co., Inc. (Long Island City, NY), Type 3C.
5. Vibration Mountings & Controls, Inc. (Butler, NJ), Type RHD.
6. Approved equal

B. HN (hanger neoprene) isolators shall consist of a neoprene-in-shear element contained within a steel housing. A neoprene neck bushing shall be provided where the hanger rod passes through the hanger housing to prevent the rod from contacting the hanger housing. A pre-compressed glass fiber element may be substituted for the neoprene element.

C. HN isolators shall be selected to achieve 1/10" minimum static deflection under load.

PART 3 EXECUTION

3.01 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70.
  1. Size steel hanger rods for individual hangers and trapeze supports as indicated in the following schedule. Total weight of equipment shall not exceed limits indicated.

<u>Maximum Loads (lbs)</u>	<u>Rod Diameter (")</u>	<u>Maximum Pipe Size With Single Rod</u>
730	3/8	2"
1130	1/2	3"
1818	5/8	5"

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25% in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with 2-bolt conduit clamps.



- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 3/4” and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

### 3.02 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements, except as specified in paragraphs below.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor application size and placement shall be reviewed and approved by Structural Engineer prior to installation. 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: Beam clamps (MSS 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 by means that meet seismic-restraint strength and anchorage requirements.
  - 8. Powder actuated driven anchors are not allowed.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.
- F. Do not support raceway by other raceway.
- G. Do not support equipment or raceway from metal roof decking or floor decking.
- H. Do not impose weight of electrical equipment, raceways, or lighting fixtures on support provided for other trades or systems.
- I. Top or bottom chords of open web steel joists may be used to support loads provided total load within panel does not exceed 100 lbs and load is placed concentric to joist (panel is length of chord between two adjacent diagonal web members at point of connection to chord).
  - 1. C-clamps are not permitted for use in open web steel joist applications.
- J. Suspend hangers by means of hanger rods. Perforated band iron and flat wire (strap iron) are not allowed.
- K. Use conduit-mounting pedestals for piping on roof. Install bottom of pedestal flat on roof deck and insulate exterior of pedestal, flashing and counter flashing.

- L. Minimize use of concrete anchors and inserts after concrete pour.
- M. Punching, drilling, welding of building structural steel or welding attachment to building structural steel is not allowed, unless approved by structural engineer.
- N. Use tools approved for use with PVC-coated conduits and fittings.

### 3.03 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. Touchup: Comply with requirements in Division 09 Section "Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

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SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 26 0519 – Low-Voltage Electrical Power Conductors and Cables
- B. Section 26 0526 – Grounding and Bonding for Electrical Systems
- C. Section 26 0529 – Hangers and Supports for Electrical Systems
- D. Section 26 0548 – Vibration and Seismic Controls for Electrical Systems
- E. Section 26 0553 – Electrical Systems Identification
- F. Section 26 0593 – Electrical Systems Firestopping
- G. Section 26 2726 – Wiring Devices
- H. Section 27 0553 – Communications Systems Identification
- I. Section 27 1100 – Communications Equipment Room Fittings
- J. Section 27 1300 – Communications Backbone Cabling
- K. Section 27 1500 – Communications Horizontal Cabling

1.02 REFERENCE

- A. Work under this section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.03 DESCRIPTION

- A. Section includes raceways, fittings, wireways, wall ducts, indoor service poles, outlet boxes, pull and junction boxes, floor boxes, tap boxes and raceway seals.

1.04 REFERENCE STANDARDS

- A. ANSI/NECA 1 – Standard Practices for Good Workmanship in Electrical Contracting
- B. ANSI C80-1 – Rigid Steel Conduit-Zinc Coated (GRS)
- C. ANSI C80-3 – Electrical Metallic Tubing-Zinc Coated (EMT)
- D. ASTM A 53/A 53M – Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
- E. BICSI TDMM – Telecommunications Distribution Methods Manual, Latest Edition
- F. NEMA 250 – Enclosures for Electrical Equipment (1000 V Maximum)
- G. NEMA FB 1 – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

- H. NEMA OS 1 – Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
- I. NFPA 70 – National Electrical Code
- J. TIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces
- K. UL 1 – Flexible Metal Conduit
- L. UL 6 – Electrical Rigid Metallic Conduit-Steel
- M. UL 6A – Electrical Rigid Metallic Conduit-Aluminum and Stainless Steel
- N. UL 360 – Liquid-Tight Flexible Steel Conduit
- O. UL 514A – Metallic Outlet Boxes
- P. UL 514B – Conduit, Tubing, and Cable Fittings
- Q. UL 797 – Electrical Metallic Tubing-Steel
- R. UL 1660 – Liquid-Tight Flexible Nonmetallic Conduit
- S. UL 2024 – Optical Fiber and Communication Cable Raceway

#### 1.05 SUBMITTALS

##### A. Product Data:

1. Raceways
2. Fittings
3. Outlet boxes
4. Pull and junction boxes
5. Floor boxes
6. Raceway seals

##### B. Manufacturer's Installation Instructions:

1. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

##### C. Closeout Submittals:

1. Project Record Documents:
  - a. Record actual routing of raceways larger than 2”.
  - b. Record actual location and mounting heights of wireways, wall ducts, indoor service poles, floor boxes, tap boxes, outlet, pull and junction boxes.
2. Operation and Maintenance Data:
  - a. Include manufacturer's recommended operating instructions, maintenance procedures and intervals, and preventive maintenance instructions.
  - b. Include spare parts data listing, source, and current prices of replacement parts and supplies.

#### 1.06 QUALITY ASSURANCE

##### A. Regulatory Requirements:

1. Comply with NFPA 70.
2. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect from dirt, water, construction debris, and traffic.
- B. Comply with manufacturer's written instructions.

#### 1.08 WARRANTY

- A. Refer to Division 01 and Section 26 0000 – General Electrical Requirements for general warranty requirements.
- B. Manufacturer shall provide standard 1 yr written warranty against defects in materials and workmanship for products specified in this Section. Warranty period shall begin on date of final acceptance.

### PART 2 PRODUCTS

#### 2.01 RIGID METAL CONDUIT (RMC)

- A. Rigid Steel Conduit (RSC): ANSI C80.1, UL 6; heavy wall galvanized steel
- B. Fittings (couplings, connectors and bushings): NEMA FB 1, UL 514B; steel (concrete-tight where applicable); threaded; connectors with double locknuts and steel insulating bushings, thermoplastic insulating bushings for conduits 2" and smaller.
- C. Fittings Manufacturers: Cooper Crouse-Hinds; Carlon Electric Products/Prime Conduit Inc.; O-Z/Gedney; Appleton; Hubbell; Approved equal.

#### 2.02 ELECTRICAL METALLIC TUBING (EMT)

- A. ANSI C80.3, UL 797; galvanized steel tubing
- B. Fittings (couplings and connectors): NEMA FB I, UL 514B; steel, watertight gland compression type connectors with double locknuts and insulated throat. Indentor, drive-on, zinc die-cast or pressure cast not permitted.
- C. Fittings Manufacturers: Same as manufacturers listed in 2.1.C.

#### 2.03 FLEXIBLE METAL CONDUIT (FMC)

- A. UL 1; interlocked steel
- B. Fittings: NEMA FB I, UL 514B; steel, die-cast fittings not permitted

#### 2.04 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. UL 360; interlocked steel, with PVC jacket
- B. Fittings: NEMA FB 1, UL 514B; steel

## 2.05 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, UL 514A; galvanized steel with stamped knockouts.
  - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; 1/2" male fixture studs, where required.
  - 2. Concrete Ceiling Boxes: Concrete type
- B. Cast-Metal Outlet Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover and threaded hubs
  - 1. For applications requiring more than 2 gang boxes, provide stainless steel custom fabricated welded boxes with threaded hubs and coverplate. For applications including terminations and splicing of power conductors, a standard UL Listed box shall be used inside of the custom fabricated box.
- C. Nonmetallic Outlet Boxes: NEMA OS 2
- D. Gangable type boxes are not allowed.
- E. Manufacturers: O-Z/Gedney; Raco; Cooper Crouse-Hinds; Approved equal.

## 2.06 OUTLET BOXES FOR COMMUNICATIONS

- A. Minimum outlet box size: 4-11/16" square by 2-1/8" deep minimum, with single-gang trim ring, unless otherwise noted on drawings.
  - 1. Total depth of the assembly including the trim ring shall not be less than 2-1/2".

## 2.07 PULL AND JUNCTION BOXES

- A. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1; galvanized steel
- B. Cast-Metal, Pull, and Junction Boxes: NEMA FB 1; cast aluminum with ground flange, gasketed cover and stainless steel cover screws
- C. Minimum size: 4" square by 2-1/8" deep for use with 1" conduit and smaller; 4-11/16" square by 2-1/8" deep for use with 1-1/4" conduit and larger
- D. Sheet Metal Boxes Larger Than 12" in any direction: Hinged cover or a chain installed between box and cover
- E. Field-fabricated boxes not allowed without prior approval of local authority having jurisdiction.
- F. Manufacturers: O-Z/Gedney; Raco; Cooper Crouse-Hinds; Approved equal.

## 2.08 PULL AND JUNCTION BOXES FOR COMMUNICATIONS

- A. Size: Per TIA-569-B, unless otherwise noted on drawings.
- B. Minimum pull box size: 4-11/16" square by 2-1/8" deep, where pull box is used with raceway(s) smaller than 1-1/4" trade size, unless otherwise noted on drawings.
- C. Minimum pull box size, where pull box is used with raceway(s) 1-1/4" trade size or larger:
  - 1. For straight pull through: Length of at least 8 times trade-size diameter of largest raceway.
  - 2. For angle and U pulls:

- a. Have distance between each raceway entry inside box and opposite wall of box of at least 6 times trade-size diameter of largest raceway, this distance being increased by sum of trade-size diameters of other raceways on same wall of box; and
- b. Have distance between nearest edges of each raceway entry enclosing same conductor of at least:
  - 1) Six times trade-size diameter of raceway; or
  - 2) Six times trade-size diameter of larger raceway if raceways are of different sizes.
- c. For raceway entering wall of pull box opposite to removable cover, have distance from wall to cover of not less than trade-size diameter of largest raceway plus 6 times diameter of largest conductor.

## 2.09 FIRE RATED POKE THRU DEVICES

### A. Manufacturers:

1. Hubbell – S1R Series
2. FSR – SF Series
3. Legrand - Evolution Series

### B. Power Only Poke Thru (PT1):

1. Two compartment assembly.
2. Designed to be installed in concrete floors.
3. Assembled unit shall include two pre-wired 20A duplex receptacles.
4. Activations to be fully recessed in poke thru device below floor surface level.
5. Die-cast aluminum flanged cover assembly with brushed aluminum finish and insert area in lid for carpet cutouts to match finished floor.
6. Fire rated for up to 2-hour rated floors.
7. Comply with UL 514A and UL 514C scrub water exclusion test for tile, terrazzo, carpet and wood floors.

### C. Combination Power/Data Poke Thru (PT2):

1. Assembled unit shall include two pre-wired 20A duplex receptacles installed in the side compartment and a 1-gang device plate in the center compartment to accept communications devices.
2. Communication Modules Mounting Accessories: Complete line of faceplates and bezels provided by floor box manufacturer to facilitate mounting of coaxial, high-performance twisted-pair cabling and communication devices. Cabling type and faceplate configurations per requirements in Section 27 1500 – Communications Horizontal Cabling. The box shall accommodate workstation connectivity outlets and modular inserts and other system devices.
3. Devices to be fully recessed in poke thru device.
4. Die-cast aluminum flanged cover assembly with brushed aluminum finish and insert area in lid for carpet cutouts to match finished floor.
5. Route 1" conduit from the communications compartment to accessible ceiling space to accommodate communications cabling.
6. Fire rated for up to 2-hour rated floors.
7. Comply with UL 514A and UL 514C scrub water exclusion test for tile, terrazzo, carpet and wood floors.

### D. Combination Power/Data/Audio/Visual Poke Thru (PT3):



1. Assembled unit shall include pre-wired 20A duplex receptacles and device plate in the center compartment to accept communications devices and AV devices. Refer to AV drawings for additional information.
2. Communication Modules Mounting Accessories: Complete line of faceplates and bezels provided by floor box manufacturer to facilitate mounting of coaxial, high-performance twisted-pair cabling and communication devices. Cabling type and faceplate configurations per requirements in Section 27 1500 – Communications Horizontal Cabling. The box shall accommodate workstation connectivity outlets and modular inserts and other system devices.
3. Devices to be fully recessed in poke thru device.
4. Route 1" conduit from the communications compartment to accessible ceiling space to accommodate communications cabling.
5. Fire rated for up to 2-hour rated floors.
6. Coordinate with Audio Visual (AV) drawings for boxes dimensions, mounting heights, conduit requirements and additional information.
7. AV conduit runs parallel to power conduits cannot exceed 12 inches in length.
8. Comply with UL 514A and UL 514C scrub water exclusion test for tile, terrazzo, carpet and wood floors.

#### 2.10 RACEWAY PENETRATION SEALS

- A. Thruwall and Floor Seals.
- B. Manufacturers: New construction – OZ/Gedney FSK Series; existing construction – OZ/Gedney CSM Series; or equivalent by manufacturer listed in 2.1.C.

#### 2.11 RACEWAY SEALING FITTINGS

- A. For one through four conductors: Manufacturers: OZ/Gedney CSB Series; Approved equal.
- B. For greater than four conductors: Manufacturers: OZ/Gedney EYA Series with sealing compound; Approved equal.

#### 2.12 CABLE SUPPORTS

- A. Manufacturers: OZ/Gedney Type S; or equivalent by manufacturer listed in 2.1.C.

#### 2.13 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends, with integral water stop.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052" or 0.138" thickness and of length to suit application.
- C. Integral Water Stop: Manufacturer: Thunderline Corporation; Approved equal.
  1. High density polyethylene (HDPE). Type Century-Line engineered sleeve with end caps.
  2. Steel. Type WS engineered sleeve.

#### 2.14 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Carbon steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## PART 3 EXECUTION

### 3.01 COORDINATION

- A. Coordinate with Architect/Engineer size and location of required built-in openings in building structure, including those sleeved, formed or core drilled.
- B. Coordinate with Architect/Engineer cutting, removing, or piercing general or mechanical insulation, fire-rated walls, ceilings or steelwork.
- C. Verify with Architect/Engineer all surface raceway installations except in mechanical, electrical, and communications rooms.
- D. Coordinate with Architect/Engineer exact locations of floor boxes, where shown on drawings, prior to rough-in.
- E. Coordinate routing of through-roof conduits.
- F. Coordinate sleeve selection and application with selection and application of firestopping specified in Section 26 0593 – Electrical Systems Firestopping.
- G. Verify that exterior wall or wet location boxes are gasketed type cast boxes with matching cover.

### 3.02 EXAMINATION

- A. Examine surfaces to receive raceways and boxes for compliance with installation tolerances and other conditions affecting performance of raceway's installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.03 INSTALLATION

- A. Raceways:
  1. Comply with ANSI/NECA 1 and NFPA 70 for installation requirements applicable to products specified in Part 2 except where requirements on drawings or in this Section are stricter.
  2. Arrange raceways to maintain headroom and present neat appearance.
  3. Raceway routing is shown in approximate locations, unless dimensioned. Route to complete raceway installation before starting conductor installation.
  4. Keep raceways at least 12" away from parallel runs of flues, steam, hot-water pipes or ductwork. Install horizontal raceway runs above water and steam piping. Install raceways level and square and at proper elevations: 6'-6" minimum headroom, except in exit pathways 7'-0" minimum headroom. Do not block access to junction boxes, mechanical equipment or prevent removal of ceiling panels, etc.
  5. Run raceways concealed in construction to avoid adverse conditions such as heat and moisture, to permit drainage, and to avoid materials and equipment of other trades, except where noted otherwise.
  6. Avoid exposed raceway runs. Run raceways exposed where impractical or impossible to conceal or where specific approval is obtained. Run exposed raceways grouped and parallel

- or perpendicular to construction. Do not route exposed raceways over boilers or other high-temperature machinery or in contact with such equipment. Offset exposed raceways at boxes.
7. Route raceways installed above accessible ceilings parallel or perpendicular to construction.
  8. Do not install raceways in structural or topping floor slabs, except where noted on the plans. Install raceway in structural or topping floor slabs, where noted on plans, as follows:
    - a. Center raceways in structural slabs clear of reinforcing steel, except where crossing same, and spaced on centers equal or exceeding 3 times the raceway diameter. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement. Space raceways laterally to prevent voids in concrete.
    - b. Outside diameter of raceway shall not exceed 1/3 the structural slab thickness.
    - c. Obtain approval from Engineer for each run of raceway 1" or larger.
    - d. Do not install raceways in topping slabs of 2" or less.
    - e. Locate raceways to avoid conflict with equipment, door bucks, partitions and other equipment bolted to floor.
    - f. Arrange stub-ups so curved portions of bends are not visible above finished slab. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; use flexible metal conduit 6" above the floor. Install threaded plugs flush with floor for future equipment connections.
    - g. Change from nonmetallic raceway to RMC or IMC before rising above floor.
  9. Cut raceways square using saw or pipecutter.
  10. Use hydraulic one-shot raceway bender or factory elbows for bends in raceway larger than 2", unless sweep elbows required. Bend raceways according to manufacturer's recommendations. Do not use torches or open flame to aid in bend of PVC conduit.
  11. Use raceway fittings compatible with raceways and suitable for use and environment.
  12. Provide bushings on all raceways 1-1/2" and larger.
  13. Raceways minimum sizes:
    - a. Minimum raceway size 3/4", except as noted on drawings or where connection to existing boxes with 1/2" knockouts is necessary.
    - b. Minimum home run size: 3/4", except as noted on drawings.
    - c. Minimum size for flexible metal conduit is 1/2" except 3/8" for luminaires.
    - d. Minimum size for liquid-tight flexible metal conduit is 1/2"
  14. Feed devices on same wall vertically from above or junction box in suspended ceiling.
    - a. Do not install horizontal bends in conduit around corners.
    - b. Feed devices in exterior or load-bearing walls by horizontal conduit runs.
    - c. Where horizontal conduit runs are required or allowed, install conduits from device to device on same wall.
  15. Raceways Supports:
    - a. Independently support or attach raceway system to structural parts of construction. Suspended ceiling systems shall not be considered as structural parts of construction for raceway support. Do not attach raceways to piping system.
    - b. Raceway supports for horizontal or vertical single runs:
      - 1) Hot dipped galvanized heavy-duty sheet steel straps, mineralac clamps or steel slotted support channel system with appropriate components.
      - 2) Spring steel type pressure clamps for raceways 3/4" and smaller.
    - c. Raceway supports for horizontal and vertical multiple runs:

- 1) Trapeze-type supports fabricated with steel slotted channel systems with appropriate components.
  - 2) Support horizontal runs with appropriately sized rods.
  - 3) Anchor vertical runs to structure.
  - 4) Spring-steel type pressure clamps for raceways 3/4" and smaller.
  - d. Vertical raceway runs 1-1/4" and larger passing through floors: Support at each floor with pipe riser clamps.
  - e. Do not support raceways with wire, perforated pipe straps or plastic tie-wrap. Remove wires used for temporary support.
  - f. Secure raceways in metal stud walls to prevent rattling.
  - g. Arrange raceway supports to prevent misalignment during wiring installation.
  - h. Do not fasten raceways to corrugated metal roof deck.
  - i. For fasteners and supports, including steel slotted support systems, support devices, support spacing, support of conductors in vertical raceways, and hanger rod size, refer to Section 26 0529 – Hangers and Supports for Electrical Systems and NFPA 70.
16. Raceways Seismic Restraints:
- a. Avoid raceway runs crossing building seismic joints. Use flexible connections where crossings cannot be avoided.
  - b. Install rigid bracing and lateral restraints for suspended raceway runs per requirements in Section 26 0548 – Vibration and Seismic Controls for Electrical Systems.
17. Identify raceways per requirements in Section 26 0553 – Electrical Systems Identification.
18. Ground raceways per requirements in Section 26 0526 – Grounding and Bonding for Electrical Systems.
19. Flexible Conduit Connections: Use maximum of 72" of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for motors.
- a. Use LFMC in damp or wet locations not subject to severe physical damage.
20. Install stainless steel raceway clamps, mounting hardware, supports, hangers, etc., when located in "wet" or "wash-down" areas.
21. Communications Raceways:
- a. Minimum communications raceway size: 1", unless otherwise noted on drawings.
  - b. Install one raceway from each communications outlet box. Horizontal raceway runs between wall outlet boxes are not allowed.
  - c. Terminate raceway above closest accessible ceiling space.
  - d. Install insulated bushings on end of each raceway.
  - e. Use UL listed metallic grounding clamps, when terminating raceway on cable tray.
  - f. Install flush two-gang box with single-gang trim ring for each communications outlet or as noted on drawings.
  - g. Install with no more than 180 degrees of bends between pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
  - h. Conduit bend radii (minimum) shall be:
    - 1) Six (6) times internal conduit diameter for conduit 2" or less internal diameter.
    - 2) Ten (10) times internal conduit diameter for conduit greater than 2" internal diameter.
  - i. Conduit bends shall be smooth, even, and free of kinks or other discontinuities that may have detrimental effects on pulling tension or cable integrity during or after installation.
  - j. Do not install 90-degree condulets. Install continuous radius sweeps of 45° minimum for 90-degree bends.

- k. Do not install continuous sections longer than 100 ft.
  - l. Install nylon pull cord in empty raceways. Leave at least 12" of slack at each end of pull wire. Cap raceways at both ends.
- 22.** Power and low-voltage raceways: Minimum 12" separation when run parallel, cross perpendicular.

**B. Boxes:**

1. Install boxes to accommodate device indicated by symbol, in conformance with code requirements, number and size of conductors and splices and consistent with type of construction.
2. Install the appropriate cover on surface-mounted boxes:
  - a. Raised device covers on 4" square and 4-11/16" boxes and handy box covers on handy boxes, etc.
  - b. Device covers that are square drawn or square cut on boxes in block.
  - c. Tile covers on boxes in tile.
  - d. Round drawn device covers on boxes in lath and plaster walls or dry wall only.
  - e. Set front edge of device boxes flush with finished wall surfaces except on walls of non-combustible materials where boxes may have maximum set back of 1/4". Secure flush-mounted box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
3. Set outlet boxes parallel to construction and independently attached to same.
4. Do not install back-to-back and through-the-wall boxes. Install with minimum 6" horizontal separation between closest edges of the boxes. Install with minimum 24" separation in acoustic-rated walls and fire-rated walls.
5. Install multi-ganged boxes where 2 or more devices are in same location, unless otherwise noted.
6. Box Support:
  - a. Mount boxes straight.
  - b. Install horizontal bracing at top or bottom of box for 3 or more gang device boxes in stud walls.
  - c. Install stud support one side, with short piece of stud, for up to 2 gang device boxes.
  - d. Do not support boxes with tie-wire.
  - e. For one and two gang box support, manufactured bracket supports shall be accepted alternate.
  - f. Support boxes independently of raceways.
  - g. Install adjustable steel channel fasteners for hung ceiling outlet box.
  - h. Install stamped steel bridges to fasten flush-mounted outlet box between studs.
  - i. Do not install boxes to ceiling support wires or piping systems.
7. Install partitions in multi-ganged boxes where different types of devices are installed, or devices installed operate at different voltages.
8. Mount boxes in block walls at block joint nearest to indicated height.
9. 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.
10. When boxes are installed in fire-resistive walls and partitions, provide 24" horizontal separation between boxes on opposite sides of a wall. In addition, limit penetrations to 16 sq in per penetration and not to exceed a total of 100 sq in per 100 sq ft of wall area. Apply fire stop putty pads acceptable to the fire marshal.

11. Pull and junction boxes: Install as shown, or as necessary to facilitate pulling of wire and to limit number of bends within code requirements. Install above accessible ceilings and in unfinished areas.
  12. Install boxes to be permanently accessible.
  13. Do not intermix conductors from more than one system in same junction box or pull box, unless shown or specifically authorized otherwise.
  14. Adjust box location up to 10' prior to rough-in to accommodate intended purpose.
  15. Orient boxes to accommodate wiring devices oriented as specified in Section 26 2726 – Wiring Devices.
  16. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6" from ceiling access panel or from removable recessed luminaire.
  17. The drawings do not necessarily show every outlet, pull or junction box required. Add all required boxes as necessary.
- C. Outlet Boxes for Communications:
1. Install communications outlet boxes for each communications outlet, or as noted on drawings.
  2. Coordinate with other trades to maintain 8" clear space (minimum, measured from box centerline) on all sides of wall-mounted telephone outlet box.
- D. Pull and Junction Boxes for Communications:
1. Position Communications Pull and Junction Boxes:
    - a. In any section of conduit longer than 100 ft
    - b. Where there are bends totaling more than 180 degrees between pull points or pull boxes
    - c. Wherever there is a reverse bend in run
  2. Do not use pull boxes in place of bends on straight section of raceway, unless otherwise shown on drawings.
- E. Fire rated poke thrus:
1. Set metal poke thrus level and flush with finished floor surface.
  2. Install poke thrus and fittings to preserve fire-resistant rating of slabs and other elements, using materials and methods specified in Section 26 0593 – Electrical Systems Firestopping.
  3. Identify communication outlets per requirements in Section 27 0553 – Communications Systems Identification.
  4. Power and IT or AV conduits require a minimum 12" separation where routed parallel including entry into floor boxes.
- F. Raceway Penetration Seals:
1. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
  2. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Maintenance of Joint Protection" for materials and installation.
  3. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Section 26 0593 – Electrical Systems Firestopping.
  4. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1" annual clear space between pipe and sleeve for installing mechanical sleeve seals.

5. Sleeve-Seal Installation: Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
6. Provide chrome- or nickel-plated escutcheons where raceways pass through walls, floors or ceilings and are exposed in finished areas. Size escutcheons to fit raceways for finished appearance. Finished areas shall not include mechanical/electrical rooms, janitor's closets, storage rooms, etc., unless suspended ceilings are specified.
7. Remove temporary sleeves, if used for form wall openings, prior to installation of permanent materials.

G. Raceway Sealing Fittings:

1. Install listed watertight seals to prevent the passage of moisture and water vapor through raceway, where raceway passes from interior to exterior of the building, where raceway passes between areas of different temperatures such as into or out of cold rooms or freezers, where raceway enters room which at any time is subject to low or high temperatures and where raceway enters a room which at any time is subject to internal air pressures above or below normal.
2. Install watertight seals in interior of all raceways passing through building roof, ground floor slab (when the raceway does not extend beyond building footprint), or through outside walls of building above or below grade. Seal on the end inside building, using raceway sealing fittings manufactured for the purpose. Locate fittings at suitable accessible locations. For concealed raceways install each fitting in flush steel box with blank coverplate to match finish of adjacent plates or surfaces.
3. Seal raceways entering or passing through "hazardous (classified) areas" as defined in NFPA 70.

H. Sleeve Installation for Electrical Penetrations:

1. Coordinate sleeve selection and application with selection and application of firestopping specified in Section 26 0593 – Electrical Systems Firestopping.
2. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
3. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
4. Rectangular Sleeve Minimum Metal Thickness:
  - a. For sleeve cross-section rectangle perimeter less than 50" and no side greater than 16", thickness shall be 0.052".
  - b. For sleeve cross-section rectangle perimeter equal to, or greater than, 50" and 1 or more sides equal to, or greater than, 16", thickness shall be 0.138".
5. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies, unless openings compatible with firestop system used are fabricated during construction of floor or wall.
6. Cut sleeves to length for mounting flush with both surfaces of walls.
7. Extend sleeves installed in floors 2" above finished floor level.
8. Size pipe sleeves to provide 1/2" annular clear space between sleeve and raceway, unless sleeve seal is to be installed or unless seismic criteria require different clearance.

3.04 APPLICATION

- A. Provide raceways and boxes in accordance with the following table:

Application	Approved Raceways	Approved Boxes	Application Notes
Outdoor Locations, Above Grade	rigid (steel) conduit	Cast Metal	
Wet and Damp Locations	rigid (steel) conduit	Cast Metal. Install flush mounting outlet boxes in finished areas	
Concealed Dry Locations	electrical metallic tubing	Sheet Metal Boxes; Install flush mounting outlet boxes in finished areas; Install hinged enclosure for large pull boxes.	
Exposed Dry Locations	rigid (steel) conduit	Sheet Metal boxes; Install flush mounting outlet boxes in finished areas; Install hinged enclosure for large pull boxes.	
Exposed Subject to Damage	rigid steel conduit	Cast Metal	
Locations requiring Mechanical Protection	Rigid Steel Conduit		
Instruments & control devices	Liquid Tight Flexible Metal Conduits		Lengths for LFMC may range between 2 ft to 4 ft

3.05 FIELD QUALITY CONTROL

- A. Inspect raceway, boxes, indoor service poles, and wireways for physical damage, proper alignment, supports and seismic restraints, where applicable.
- B. Replace any damaged component of the raceway system or install new raceway system.
- C. Inspect components, wiring, connections and grounding.

3.06 REPAINTING

- A. Repair damage to galvanized finishes with manufacturer-supplied zinc-rich paint kit. Leave remaining paint with Owner.
- B. Repair damage to paint finishes with manufacturer-supplied touch-up coating. Leave remaining coating with Owner.



### 3.07 ADJUSTING

- A. Adjust flush-mounted boxes pre-pour and after-pour to be flush with finished materials.
- B. Install knockout closures in unused openings in boxes.
- C. Align adjacent wall-mounted outlet boxes for switches and similar devices.
- D. Adjust outlet boxes to allow luminaires to be positioned as indicated on reflected ceiling plan.

### 3.08 CLEANING

- A. Clean interior and exterior of boxes, wireways, and indoor poles to remove dust, debris and other material.

END OF SECTION

SECTION 26 05 33.13 - SURFACE RACEWAY SYSTEM

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 26 0519 – Low-Voltage Electrical Power Conductors and Cables
- B. Section 26 0526 – Grounding and Bonding for Electrical Systems
- C. Section 26 0553 – Electrical Systems Identification
- D. Section 26 2726 – Wiring Devices
- E. Section 27 0553 – Communications Systems Identification
- F. Section 27 1500 – Communications Horizontal Cabling

1.02 REFERENCE

- A. Work under this section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.03 DESCRIPTION

- A. Section includes surface metallic raceway system for branch circuits, and data network.
- B. Surface raceway system shall consist of raceway bases, appropriate fittings, and device mounting plates necessary for a complete installation.
- C. The lengths of the raceways shown on drawings are illustrative and diagrammatic only and are not accurate. Raceways shall be provided completely installed to match lengths indicated on drawings. Receptacle circuits shall be pre-wired.

1.04 REFERENCE STANDARDS

- A. ANSI/NECA 1 – Standard Practices for Good Workmanship in Electrical Contracting
- B. NFPA 70 – National Electrical Code
- C. UL 5 - Surface Metal Raceways and Fittings
- D. UL 5A - Nonmetallic Surface Raceways and Fittings
- E. UL 94 – Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

1.05 SUBMITTALS

- A. Product Data: Catalog cuts of components.
- B. Shop Drawings:
  - 1. Complete layout, with locations of raceway components.
  - 2. Grounding, branch circuiting, and wiring including locations of service entrances.
  - 3. Receptacle types, manufacturers, and spacing.

4. Receptacle labeling with proper voltage, phase, circuit and panelboard designations, as indicated on drawings.
  5. Communication faceplate types, manufacturers and labeling.
- C. Manufacturer's Installation Instructions:
1. Indicate application conditions and limitations of use. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- D. Closeout Submittals:
1. Project Record Documents
    - a. Record actual locations of surface raceways with receptacle types, locations and circuits identified.
  2. Operation and Maintenance Data:
    - a. Include manufacturer's recommended operating instructions, maintenance procedures and intervals, and preventive maintenance instructions.
    - b. Include spare parts data listing, source, and current prices of replacement parts and supplies.

#### 1.06 QUALITY ASSURANCE

- A. Obtain surface raceways from one source and by single manufacturer.
- B. Regulatory Requirements:
1. Comply with NFPA 70 for components and installation.
  2. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in clean, dry space. Maintain factory unopened packaging until ready for installation.
- B. Comply with manufacturer's written instructions.

#### 1.08 WARRANTY

- A. Refer to Division 01 and Section 26 0000 – General Electrical Requirements for general warranty requirements.
- B. Manufacturer shall provide standard 1 yr written warranty against defects in materials and workmanship for products specified in this Section. Warranty period shall begin on date of substantial completion.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Metallic Raceways:
1. Hubbell
  2. Legrand/Wiremold
  3. Mono-Systems
  4. Approved Equal

## 2.02 FABRICATION

### A. UL 5, UL 5A, as applicable

### B. Fabrication:

1. Aluminum
2. Suitable for use in dry interior locations only.
3. Two-piece with base and snap-on cover
4. Base: single or two compartment fixed dividers and cover plate, as indicated on drawings
5. Two-compartment raceway with separate cover for each compartment.
6. Covers with cutouts for device plates as shown on drawings.
7. 6" and 12" long device plates with flange to overlap joint of adjacent cover.

### C. Prewired Raceways:

1. Wiring devices factory installed, wired, and covers labeled with panel number and circuit number, voltage, phase, and amperes, as identified on drawings, per requirements in Sections 26 0519 – Low-Voltage Electrical Power Conductors and Cables and 26 2726 – Wiring Devices.
2. Raceway sections with 12" pigtails at feed locations, in 2 ft minimum length and customized to match length shown on drawings.
3. Equivalent distance between receptacles; number of receptacles per length of raceway as shown on drawings.
4. Factory installed, NFPA 70 sized, grounding conductors, per requirements in Section 26 0526 – Grounding and Bonding for Electrical Systems.
5. Raceway covers with hole-cut provisions for communication outlets.
6. Wiring devices on top and communication outlets on bottom.

### D. Material:

1. Aluminum Raceways: Alloy 6063-T5 extruded aluminum, minimum thickness 0.060"
2. Fittings: Same material and metal thickness as linear raceway components.

### E. Finish:

1. Aluminum Raceways:
  - a. Satin, No. 204 clear anodized 0.004" thick, Class R1 Mil-Spec.
2. Fittings: Color to match linear raceway components.

### F. Accessories:

1. Fittings: Available as standard accessories, including external corner units, internal corner units, flat units, blank end units, internal and external elbows, coupling for joining raceway sections, and device mounting brackets and plates.
2. Wire Clips: One for every 2 linear ft of indicated raceway configuration.
3. Corner elbows and tee fittings, to maintain 2" cable bend radius that meets requirements for communications pathways and specifications for fiber optic, coaxial, and high-performance twisted-pair cabling.
4. Device Mounting Brackets and Plates: Plastic device mounting brackets and trim plates allowing installation of indicated wiring devices, and communications outlets horizontally in raceways; trim cover sized to overlap device cut-out in raceway, concealing seams; finished to match linear raceway components; plastic compatible with UL 94; brackets and plates, to match raceway width, and with device mounting holes.

G. Communications Outlets and Accessories:

1. Cabling Type: Per requirements in Section 27 1000 – Structured Cabling and Section 27 1500 – Communications Horizontal Cabling.
2. Mounting faceplates and bezels: Faceplates configuration per requirements in Section 27 1000 Structured Cabling and Section 27 1500 – Communications Horizontal Cabling.

PART 3 EXECUTION

3.01 COORDINATION

- A. Coordinate cover plate openings with the wiring devices contained within.
- B. Coordinate cover plate openings with the communications outlets contained within, to provide for one opening for each communication symbol shown on drawings in Division 27. Coordinate device plate sizes (single-gang or two-gang) to accept communication faceplate types specified in Section 27 1000 – Structured Cabling and Section 27 1500 – Communications Horizontal Cabling.
- C. Verify with manufacturer that 'touch-up' paint kit is available for repainting.
- D. Coordinate surface raceways installation with (laboratory) casework shop drawings to match lengths of cabinets and shelving.
- E. Verify location of raceways with architectural interior elevation drawings.

3.02 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect/Engineer of unsatisfactory preparation before proceeding.

3.03 INSTALLATION

- A. Install in accordance with ANSI/NECA 1 and manufacturer's instructions.
- B. Install flathead screws, clips and straps to fasten surface raceways to substrates, ensuring they are permanently and mechanically anchored. Double-sided adhesive is not acceptable. Mount plumb and level. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
- C. Install wiring devices and communications outlets of type, quantity and spacing as indicated on drawings.
- D. Mount raceways on wall parallel to or at right angles to structure and casework.
- E. Feed raceways mounted on walls from a backbox through a wall box connector. Determine point of feed in field and complete wiring connections.
- F. Install a chase nipple extension between outlet box on wall and raceway when raceway mounted to support channel for modular casework.
- G. Maintain ground continuity throughout entire raceway length per requirements in Section 26 0526 – Grounding and Bonding for Electrical Systems.
- H. Do not field cut prewired raceways.

- I. Install appropriate backbox extension rings where raceway is mounted to steel slotted channel or by some other method, stood off from wall.
- J. Raceway receptacle faceplates shall be labeled with adhesive labels with 1/4" high lettering, per requirements in Section 26 0553 – Electrical Systems Identification, indicating receptacle voltage, phase, and amperage (i.e., 120V, 1-phase, 20A) at top of receptacle, and panel and circuit designation (i.e., NLP-D2-2/12) at bottom of receptacle, in accordance with requirements in Section 26 0553 – Electrical Systems Identification, for 15A, 20A and 30A receptacles.
- K. Reinforce each cover section for every 30A receptacle in raceway with two 4-40 Phillips counter-sunk steel screws attached to enclosure near top and bottom of receptacle.
- L. Identify communication outlets per requirements in Section 27 0553 – Communications Systems Identification.
- M. Raceway base shall be secured using screws. Securing with double-sided adhesive is not acceptable.

#### 3.04 FIELD QUALITY CONTROL

- A. Inspect surface raceways for physical damage and proper alignment.
- B. Inspect components, wiring, connections, installation, and grounding.

#### 3.05 REPAINTING

- A. Remove paint splatters and other marks from surface of equipment.
- B. Touch-up chips, scratches, or marred finishes to match original finish, using manufacturer-supplied paint kit. Leave remaining paint with Owner.

#### 3.06 CLEANING

- A. Vacuum dirt and construction debris from interior and exterior of equipment; do not use compressed air to assist in cleaning.

END OF SECTION

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## SECTION 26 05 48 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

### PART 1 GENERAL

#### 1.01 RELATED WORK

- A. Section 26 0529 – Hangers and Supports for Electrical Systems
- B. Section 26 0533 – Raceway and Boxes for Electrical Systems
- C. Section 26 2816 – Enclosed Switches and Circuit Breakers
- D. Section 26 5100 – Interior Lighting

#### 1.02 REFERENCE

- A. Work under this section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions and sections under Division 01 General Requirements.

#### 1.03 DESCRIPTION

- A. Section includes requirements for seismic restraints, vibration control and anchorage to building structure of electrical systems, including equipment specified in paragraph “Related Work”, raceways, cable trays, and lighting fixtures:
  - 1. Seismic restraints, vibration control and anchorage to building structure shall meet ratings applicable to seismic Design Category.
- B. Obtain services of Engineer registered and licensed in the State of North Carolina to design seismic restraints, vibration control and methods of anchorage of electrical systems to building structure. This shall include preparation of a Quality Assurance Plan and performance of special inspections required by Chapter 17 of the North Carolina Building Code.
- C. Seismic anchorage and restraints shall be designed and installed in accordance with codes and standards as enforced by Authorities Having Jurisdiction in the State of North Carolina. Authorities shall include Owner’s insurance company.

#### 1.04 REFERENCE STANDARDS

- A. ASTM A 492 – Specification for Stainless Steel Rope Wire
- B. ASTM A 603 – Specification for Zinc-Coated Steel Structural Wire Rope
- C. ASTM E 488 – Specification for Test Methods for Strength of Anchors in Concrete and Masonry Elements
- D. AWS D1.1/D1.1M – Structural Welding Code – Steel
- E. IBC – International Building Code
- F. ICC-ES – International Code Council Evaluation Service
- G. MFMA-3 – Metal Framing Standards Publication
- H. NFPA 70 – National Electrical Code



- I. NFPA 5000 – Building Construction and Safety Code
- J. SEI/ASCE 7 – Structural Engineering Institute/American Society of Civil Engineers - Minimum Design Loads for Buildings and Other Structures

#### 1.05 PERFORMANCE REQUIREMENTS

- A. Governing Codes:
  - 1. 2006 IBC, Section 1613, which references and modifies SEI/ASCE 7-05, Chapter 13
- B. In Sections for equipment and components in structures with an Importance Factor greater than 1.0 in IBC Seismic Design Category C, D, E, or F, a “Manufacturer Seismic Qualification Certification” is required in Part 1 “Submittals” Article that certifies that equipment will withstand seismic forces derived from criteria specified in this Section, and that equipment will remain internally intact to be operable with little or no delay.
- C. In Sections for equipment and components other than those noted above, a “Manufacturer Seismic Qualification Certification” is required in Part 1 “Submittals” Article that certifies that equipment will remain physically intact when subjected to seismic forces derived from criteria specified in this Section.
- D. Seismic-Restraint Loading:
  - 1. Building Seismic Design Category as found in the structural documents
  - 2. Occupancy Category as found in the structural documents
  - 3. Component Importance Factor:
    - a. Non-hazardous and non-life safety systems shall have component importance factor ( $I_p$ ) of 1.0.
    - b. Life safety systems shall have component importance factor ( $I_p$ ) of 1.5, and following system shall be classified as life safety systems:
      - 1) Emergency systems per NEC Article 700.
      - 2) Life safety, Critical and Equipment branch of emergency systems per NEC Article 517.

#### 1.06 SUBMITTALS

- A. Product Data: For the following:
  - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
  - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used:
    - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to Authorities Having Jurisdiction.
    - b. Annotate to indicate application of each product submitted and compliance with requirements.
  - 3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.
- B. Shop Drawings:
  - 1. Submit vibration isolation and seismic-restraint details:
    - a. Indicate fabrication and arrangement.
    - b. Detail attachments of restraints to the restrained items and to the structure.
    - c. Show attachment locations, methods, and spacings.

- d. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events.
  - e. Indicate association with vibration isolation devices.
  2. Submit design calculations. Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints:
  3. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other Division 26 Sections for equipment mounted outdoors.
  4. Submit design analysis to support selection and arrangement of vibration isolation and seismic restraints. Include calculations of combined tensile and shear loads.
  5. Submit welding certificate.
  6. Shop drawings, including calculations, shall be signed and sealed by an Engineer registered and licensed in the State of North Carolina.
- C. Submit manufacturer Seismic Qualification Certification of Compliance for review by Authority Having Jurisdiction, per SEI/ASCE.
- D. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

#### 1.07 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in IBC unless requirements in this Section are more stringent.
- B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M.
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to Authorities Having Jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred.
- D. Comply with NFPA 70.

### PART 2 PRODUCTS

#### 2.01 VIBRATION ISOLATORS

- A. Manufacturers:
  1. Ace Mountings Co., Inc.
  2. Amber/Booth Company, Inc.
  3. California Dynamics Corporation
  4. Isolation Technology, Inc.
  5. Kinetics Noise Control
  6. Mason Industries
  7. Vibration Eliminator Co., Inc.
  8. Vibration Isolation
  9. Vibration Mountings & Controls, Inc.

- B. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment:
  - 1. Resilient Material: Oil- and water-resistant neoprene.
- C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
  - 1. Outside Spring Diameter: Not less than 80% of the compressed height of the spring at rated load.
  - 2. Minimum Additional Travel: 50% of the required deflection at rated load.
  - 3. Lateral Stiffness: More than 80% of rated vertical stiffness.
  - 4. Overload Capacity: Support 200% of rated load, fully compressed, without deformation or failure.
  - 5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4" thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
  - 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
  - 1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4" thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
  - 2. Restraint: Seismic or limit-stop as required for equipment and Authorities Having Jurisdiction.
  - 3. Outside Spring Diameter: Not less than 80% of the compressed height of the spring at rated load.
  - 4. Minimum Additional Travel: 50% of the required deflection at rated load.
  - 5. Lateral Stiffness: More than 80% of rated vertical stiffness.
  - 6. Overload Capacity: Support 200% of rated load, fully compressed, without deformation or failure.

## 2.02 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers:
  - 1. Amber/Booth Company, Inc.
  - 2. California Dynamics Corporation
  - 3. B-Line/TOLCO; by Eaton
  - 4. Hilti Inc.
  - 5. Loos & Co.; Seismic Earthquake Division
  - 6. Mason Industries
  - 7. Anvil International
  - 8. Unistrut; Tyco International, Ltd.
  - 9. An engineered restraint system
- B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an agency acceptable to Authorities Having Jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least 4 times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- E. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod. Do not weld stiffeners to rods.
- F. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.
- G. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- H. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
- I. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

## 2.03 FACTORY FINISHES

- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
  1. Powder coating on springs and housings.
  2. Hardware shall be galvanized. Hot-dip galvanized metal components for exterior use.
  3. Baked enamel or powder coat for metal components on isolators for interior use.
  4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation after unsatisfactory conditions have been corrected.

### 3.02 APPLICATION

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to Authorities Having Jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

### 3.03 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment and Hanger Restraints:
  - 1. Install restrained isolators on electrical equipment.
  - 2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125".
  - 3. Install seismic-restraint devices using methods approved by an agency acceptable to Authorities Having Jurisdiction providing required submittals for component.
- B. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- C. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- D. Restraint cables: Provide slack with maximums recommended by manufacturer.
- E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- F. Drilled-in Anchors:
  - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
  - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
  - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
  - 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
  - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
  - 6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

### 3.04 METHODS AND MATERIALS

- A. Vibration control and seismic restraint methods and materials shall be supplementary to supporting devices and together shall serve as equipment support criteria. Provide hangers and supports in accordance with Section 26 0529 – Hangers and Supports for Electrical Systems.

### 3.05 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

### 3.06 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to Authorities Having Jurisdiction.
  - 2. Schedule test with Owner, through Architect/Engineer, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least 7 days advance notice.
  - 3. Obtain Architect's/Engineer's approval before transmitting test loads to structure. Provide temporary load-spreading members.
  - 4. Test at least 4 of each type and size of installed anchors and fasteners selected by Architect.
  - 5. Test to 90% of rated proof load of device.
  - 6. Measure isolator restraint clearance.
  - 7. Measure isolator deflection.
  - 8. Verify snubber minimum clearances.
  - 9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

### 3.07 ADJUSTING

- A. Adjust isolators after isolated equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 26 05 53 - ELECTRICAL SYSTEMS IDENTIFICATION

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 26 0516 – Owner Furnished Equipment
- B. Section 26 0519 – Low-Voltage Electrical Power Conductors and Cables
- C. Section 26 0533 – Raceways and Boxes for Electrical Systems
- D. Section 26 0923 – Lighting Control Devices
- E. Section 26 2726 – Wiring Devices
- F. Section 26 2816 – Enclosed Switches and Circuit Breakers
- G. Section 28 3116 – Multiplexed Fire Detection and Alarm Systems

1.02 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 - General Requirements.

1.03 DESCRIPTION

- A. Section includes the following:
  - 1. Identification for raceway and metal-clad cable
  - 2. Identification for conductors and communication and control cable
  - 3. Warning labels and signs
  - 4. Equipment identification nameplates
  - 5. Wiring devices identification
  - 6. Miscellaneous identification products
- B. Refer to the respective Division 26 Sections, and Sections in other Divisions that specify electrical components, for additional electrical identification requirements.

1.04 REFERENCE STANDARDS

- A. ANSI A13.1 – Scheme for the Identification of Piping Systems
- B. ANSI C2 – National Electrical Safety Code
- C. ANSI Z535.4 – National Standards for Product Safety Signs and Labels
- D. 29 CFR – Labor, Part 1910 – Occupational Safety and Health Standards, Section 1910.145 – Specifications for Accident Prevention Signs and Tags
- E. NFPA 70 – National Electrical Code

1.05 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.



- B. Nameplate Schedule: Prior to making nameplates, submit a complete schedule to Architect for approval indicating nameplate size, lettering size, color and actual nameplate information.

#### 1.06 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

#### 1.07 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

### PART 2 PRODUCTS

#### 2.01 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Manufacturers: Brady USA, Ideal, Marking Services, Inc. (MSI), Seton, or approved equal.
- C. Color for Printed Legend:
  - 1. Power Circuits: Black letters on an orange field.
  - 2. Legend: Indicate system or service and voltage, if applicable.
- D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action when placed in position.
- E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2" long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action when placed in position.

#### 2.02 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend.
- B. Manufacturers: Brady USA, Ideal, Marking Services, Inc. (MRI), Seton, or approved equal.
- C. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1" to 2" wide.

- D. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- E. Plasticized Card-Stock Tags: Vinyl cloth with preprinted and field-printed legends. Orange background, unless otherwise indicated, with eyelet for fastener.

### 2.03 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Engraved Plastic Signs: Engraving stock, melamine plastic laminate, minimum 1/16" thick for signs up to 20 sq in and 1/8" thick for larger sizes.
  - 1. Engraved legend with black letters on white face.
  - 2. Punched or drilled for mechanical fasteners.
- D. Warning label and sign shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER – ELECTRICAL SHOCK HAZARD – EQUIPMENT HAS MULTIPLE POWER SOURCES."
  - 2. Workspace Clearance Warning: "WARNING – OSHA REGULATION – AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
  - 3. Arc Flash Labels: Per ANSI Z535.4, the signal word WARNING appearing in black letters on an orange background, with second line below (Arc Flash and Shock Hazard) in black letters on white background and third line below (Appropriate PPE Required) in black letters on white background. Include the following information on the label:
    - a. Equipment name
    - b. Available bolted current
    - c. Flash protection boundary distance
    - d. Incident energy level at 18" expressed in cal/cm<sup>2</sup>
    - e. Personnel protective equipment (PPE) class
    - f. Voltage shock hazard
    - g. Limited shock approach boundary
    - h. Restricted shock approach boundary
    - i. Prohibited shock approach boundary

### 2.04 EQUIPMENT IDENTIFICATION NAMEPLATES

- A. Engraved, Three-layer, Laminated Phenolic Nameplate: Punched or drilled for screw mounting or rivets. Minimum letter height shall be 1/2" unless noted otherwise.
  - 1. Nameplates color coded as follows: 120/208 Volt Equipment – Surface: Blue, core: White
  - 2. 277/480 Volta Equipment – Surface: Black, Core: White
  - 3. Fire Alarm – Surface: Red, Core: White
  - 4. Security – Surface: Burgundy, Core: White
  - 5. Emergency – Surface: Green, Core: White
  - 6. Telephone – Surface: Orange, Core: White
  - 7. Data – Surface: Brown, Core: White

## 2.05 WIRING DEVICES IDENTIFICATION

- A. Refer to Section 26 2726 – Wiring Devices for requirements.

## 2.06 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, type 6/6 nylon cable ties.
  - 1. Minimum Width: 3/16"
  - 2. Tensile Strength: 50 lb minimum
  - 3. Temperature Range: -40°F to 185°F
  - 4. Color: Black, except where used for color-coding
- B. Paint: Paint materials and application requirements are specified in Division 09 – Finishes painting Sections.
- C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## PART 3 EXECUTION

### 3.01 APPLICATION

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Feeder, and Branch Circuits More Than 30A: Identify with orange snap-around labels.
  - 1. Identify 4" round, 4" square and 4-11/16" junction boxes concealed above ceiling or exposed with neat lettering on cover with permanent black marking pen. Identify source, circuit number, phase, and control circuit number.
- B. Accessible Raceways and Cables of Auxiliary Electrical Systems: Identify the following systems with color-coded, snap-around, color-coding bands:
  - 1. Fire Alarm System (including covers of pull and junction boxes): Red
  - 2. Security System: Blue and yellow
  - 3. Telecommunication System: Green and yellow
- C. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.
- D. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply baked-enamel warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access to equipment.
  - 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
    - a. Power transfer switches
    - b. Controls with external control power connections
  - 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
  - 3. Arc Flash Warning Labels: install per NFPA 70 for each switchgear, switchboard, panelboard, motor control center, industrial control panel (every enclosure that may contain energized conductors or components). Locate labels so they are visible to the personnel before examination, adjustment, servicing, or maintenance of the equipment.

4. Available Fault Current Labels: install per NFPA 70 for each piece of service entrance equipment. Locate labels so they are visible to the personnel before examination, adjustment, servicing or maintenance of the equipment.
  
- E. Equipment Identification Nameplates: On each unit of equipment, install unique designation nameplate that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply nameplates to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
  1. Nameplate Instructions:
    - a. Indoor Equipment: Engraved, laminated acrylic or melamine nameplate. Unless otherwise indicated, provide a single line of text with 1/2" high letters (1/4" where space is limited) on 1-1/2" high nameplate; where 2 lines of text are required, use nameplates sized 2" high.
  2. Install nameplates for equipment including, but not limited to, the following:
    - a. Panelboards, electrical cabinets, and enclosures
    - b. Access doors and panels for concealed electrical items
    - c. Emergency system boxes and enclosures
    - d. Disconnect switches
    - e. Enclosed circuit breakers
    - f. Motor controllers
    - g. Pushbutton stations
    - h. Contactors
    - i. Remote-controlled switches, dimmer modules, and control devices
    - j. Voice and data cable terminal equipment
    - k. Intercommunication and call system master and staff stations
    - l. Television/audio components, racks, and controls
    - m. Fire alarm control panel and annunciators
    - n. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks
  3. Provide the following information on each nameplate:
    - a. Equipment name/tag:
      - 1) Matching the designation from the contract documents, or identifying the load controlled or function of the equipment where no specific tag is shown on the contract documents.
      - 2) For disconnect switches, use the prefix "SW-" followed by the name of the equipment served, example: "SW-PMP-201."
    - b. Equipment operating voltage, phase, wiring configuration, and ampacity:
      - 1) Example: "208V/3PH/4W/225A"
    - c. Source of power supply, including circuit number:
      - 1) Example: "FED FROM LP-2/45"

### 3.02 INSTALLATION

- A. Verify identity of each item before installing identification products.

- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Install non-adhesive signs and plastic nameplates parallel to equipment lines; attach with screws and auxiliary hardware appropriate to the location and substrate. Secure to inside surface of door or panelboard that is recessed in finished locations.
- F. Posted Drawings and Operating Instructions: Mount drawings and operating procedures on the wall immediately adjacent to the piece of equipment for which the instructions apply. If sufficient wall space is available, mount directly to one of the sheet metal panels of the equipment.
- G. Warning Signs: Install warning signs where there is hazardous exposure or danger associated with access to or operation of electrical facilities. Provide text of sufficient clarity and lettering of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with ANSI A13.1 standard color and design.
  - 1. Operational Tags: Where needed for proper and adequate information on operation and maintenance of electrical systems, provide tags of plasticized card stock, either preprinted or hand printed to convey the message; example: "DO NOT OPEN THIS SWITCH WHEN BREAKER IS CLOSED."
- H. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50 ft maximum intervals in straight runs, and at 25 ft maximum intervals in congested areas.
- I. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded branch-circuit conductors.
  - 1. Color shall be factory applied.
  - 2. Colors for 208/120 V Circuits:
    - a. Phase A (left bus in panelboard): Black
    - b. Phase B (center bus in panelboard): Red
    - c. Phase C (right bus in panelboard): Blue
    - d. Neutral: White
    - e. Equipment Ground: Green
  - 3. Colors for 480/277 V Circuits:
    - a. Phase A (left bus in panelboard): Brown
    - b. Phase B (center bus in panelboard): Orange
    - c. Phase C (right bus in panelboard): Yellow
    - d. Neutral: Gray
    - e. Equipment Ground: Green
  - 4. Field-applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6" from terminal points and in boxes where splices or taps are made. Apply last two runs of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- J. Painted Identification: Prepare surface and apply paint according to Division 09 – Finishes painting Sections.

END OF SECTION

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SECTION 26 05 93 - ELECTRICAL SYSTEMS FIRESTOPPING

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 07 8413 – Penetration Firestopping
- B. Section 26 0533 – Raceways and Boxes for Electrical Systems

1.02 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.03 DESCRIPTION

- A. Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions (walls, partitions, floors, and ceilings) including both empty openings and openings containing electrical penetrating items, including but not limited to raceways, cables, cable trays, busways, and wireways.

1.04 REFERENCE STANDARDS

- A. ASTM E-814 – Standard Test Method for Fire Tests of Through-Penetration Firestops
- B. UL 1479 - Fire Tests of Through-Penetration Firestops

1.05 PERFORMANCE REQUIREMENTS

- A. Provide firestop system to resist spread of fire, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Firestop systems shall be UL Classified for the application and correspond to those indicated by reference to designations listed by UL Fire Resistance Directory.
- C. Conform to applicable Code requirements of Authority Having Jurisdiction.

1.06 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.
  - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetration items, including documentation of UL certification for firestop systems.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Material Safety Data Sheets provided with product delivered to job site.



- E. Certification of compliance with Building Codes of the State of Project location.
- F. Inspection reports

#### 1.07 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance.
- B. Firestopping tests shall be performed by a qualified testing and inspecting agency, or another agency performing testing and follow-up inspection services for firestop systems acceptable to Authorities Having Jurisdiction.
- C. Manufacturer's representative shall be on-site during initial installation of firestop systems to train appropriate Contractor personnel in proper selection and installation procedures.

#### 1.08 DELIVERY, STORAGE AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product, type and manufacturer, and UL Label where applicable.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.
- C. Handle in accordance with recommended procedures, precautions, or remedies described in material safety data sheets as applicable.

#### 1.09 PROJECT CONDITIONS

- A. Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop systems' manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturers' written instructions by natural means or, where this is inadequate, forced-air circulation.

#### 1.10 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Notify Owner's inspecting agency at least 7 days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.
- D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency and building inspector, if required by Authorities Having Jurisdiction.

#### 1.11 SEQUENCING

- A. Sequence work to avoid interferences with building finishes and installation of other products.

### 1.12 WARRANTY

- A. Refer to Division 01 and Section 26 0000 – General Electrical Requirements for general warranty requirements.
- B. Manufacturer shall provide standard 1 yr warranty against defects in materials and workmanship for products specified in this Section. Warranty period shall begin on date of final acceptance.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. 3M (Fire Protection Products Division), Hilti Inc, Tremco (Sealant/Weatherproofing Division), Nelson Firestop Products, Specified Technologies Inc, RectorSeal Corporation, approved equal.

### 2.02 MATERIALS

- A. Firestop Products: UL 1479, ASTM E-814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements and fire-rating involved for each separate instance; materials shall not contain flammable solvents.
- B. Firestop Systems: Produced by the same manufacturer.
- C. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
  - 1. Sealants: 250 g/L
  - 2. Sealant Primers for Nonporous Substrates: 250 g/L
  - 3. Sealant Primers for Porous Substrates: 775 g/L
- D. Fill Materials: Including the following:
  - 1. Firestop putty, caulk sealant, intumescent wrap strips, intumescent firestop collars, firestop mortars, pillows/bags, or a combination of these products to provide a UL-listed system for each application required for this Project; mineral wool backing where specified in manufacturer's application detail.
- E. Mixing
  - 1. For those products requiring mixing before application, comply with through-penetration firestop 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

### 3.01 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for opening configurations, penetrating items and other conditions affecting performance of firestopping.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Clean out openings immediately prior to installing through-penetration firestop system to comply with firestop system manufacturer's written instructions.
- B. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
- C. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

### 3.03 INSTALLATION

- A. Comply with "System Performance Requirements" Article in Part 1 and with firestop system manufacturer's written installation instructions and drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during application as required. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Each conduit penetration through a fire rated assembly is to be dedicated to a single conduit. Multiple conduits penetrating a single opening is not acceptable unless a UL listed, multi-conduit assembly is used.

### 3.04 IDENTIFICATION

- A. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include label(s) complying with 1 or 2 below.
  - 1. Custom label with the following information:
    - a. The words: "Warning—Through-Penetration Firestop System—Do Not Disturb. Notify Building Management of Any Damage."
    - b. Contractor's name, address, and phone number
    - c. Through-penetration firestop system designation of applicable testing and inspecting agency
    - d. Date of installation
    - e. Through-penetration firestop system manufacturer's name
    - f. Installer's name
  - 2. Manufacturer's preprinted labels with similar information per 1 above.

### 3.05 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified independent inspecting agency to inspect through-penetration firestop systems and to prepare test reports.
  - 1. Inspecting agency will state in each report whether inspected through-penetration firestop systems comply with or deviate from requirements.
- B. Provide certification by Installer that all through-penetration firestop systems have been firestopped in accordance with applicable Building Codes of the State of Project location.

- C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with specifications.

### 3.06 CLEANING

- A. Clean surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION

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SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 26 0000 - General Electrical Requirements
- B. Section 26 5000 - Lighting

1.02 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.03 DESCRIPTION OF SYSTEM

- A. Provide devices such as wall box dimmers, wall and ceiling mounted occupancy sensors, ambient light sensors, sensor power packs, etc., as shown on drawings.
- B. Openings shall be covered with devices and matching plates.
- C. Devices of same type shall be from same manufacturer.

1.04 REFERENCE STANDARDS

- A. UL20 - General Use Snap Switches.
- B. UL773A - Non-Industrial Photoelectric Switches for Lighting Control.
- C. UL924 - Emergency Lighting and Power Equipment
- D. NEMA WD 7 - Occupancy Motion Sensors.

1.05 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings shall include:
  - 1. Bill of material
  - 2. Schematic diagrams
  - 3. Suggested manufacturer layouts of all devices including overlays of product range.
- C. Manufacturer's Installation Instructions:
  - 1. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- D. Test Reports: Indicate field test and inspection procedures and interpret test results and corrective action taken for compliance with specification requirements.
- E. Closeout Submittals:
  - 1. Project Record Documents:
    - a. Record actual locations and type of devices.

2. Operation and Maintenance Data:
  - a. Include in manufacturers' packing label warnings and instruction manuals with labeling conditions.
  - b. Include source and current prices of replacement parts and supplies.

#### 1.06 QUALITY ASSURANCE

- A. Obtain devices from one source and by single manufacturer.
- B. Regulatory Requirements:
  1. Comply with NFPA 70 for components and installation.
  2. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in clean, dry space. Maintain factory unopened packaging until ready for installation.

#### 1.08 WARRANTY

- A. Refer to Division 01 and Section 26 0000 – General Electrical Requirements for general warranty requirements.
- B. Manufacturer shall provide standard 1 yr warranty against defects in materials and workmanship for products specified in this Section. Warranty period shall begin on date of final acceptance.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Manufacturers:
  1. Digital Wall Switches and Dimmers: Acuity Brands Controls, Cooper Controls, Hubbell, Leviton, Lutron, Philips (Sunrise Series), Wattstopper
  2. Wall switch with occupancy sensor: Wattstopper, Acuity Brands Controls, Cooper Controls, Hubbell, Leviton
  3. Digital Sensors, interface modules and Controllers: Acuity Brands Controls, Cooper Controls, Hubbell, Leviton, Lutron, Philips, Wattstopper
  4. UL 924 Emergency Bypass/Control Device: Acuity Brands Controls, Hubbell, Leviton, Wattstopper, LVS
  5. Exterior Photocells: Cooper Controls, Hubbell, Intermatic, Leviton, Paragon, Tork
  6. Timeclocks: Intermatic, Paragon, Tork
- B. It is the responsibility of Electrical Contractor to ensure devices submitted meet or exceed functional intent and design quality standards.

#### 2.02 FABRICATION AND MANUFACTURE

- A. Devices shall be UL listed for loads and voltages as indicated in contract drawings and specifications.

### 2.03 DIGITAL WALL SWITCHES AND DIMMERS

- A. Low voltage (RJ-45) momentary push button switches in 1, 2, 3, 4 and 5 button configurations, decorator opening. Wall switches will include the following features:
  - 1. Engravable buttons
  - 2. Dimming switches shall include seven LED's to indicate load levels.
  - 3. Scene switches shall include pilot indication of scene selection.
  - 4. Device Status LED's including:
    - a. One pilot LED for each button.
    - b. Power Indication
    - c. One locator LED per switch
    - d. Network status LED to indicate data transmission
    - e. Power LED to indicate the device has power
    - f. Configuration mode
- B. Switches shall have two RJ-45 ports to allow connection to any other digital room devices.
- C. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology local network. No additional configuration will be required to achieve multi-way switching.

### 2.04 DIGITAL CEILING MOUNTED OCCUPANCY SENSOR SYSTEM

- A. Wall or ceiling mounted (to suit installation) passive infrared, ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor. Furnish system which accommodates the square footage coverage requirements for each area controlled, utilizing Room Controller modules and accessories which suits the lighting and electrical system parameters.
- B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
  - 1. Digital calibration and LCD entry for the following variables:
    - a. Sensitivity 0-100% in 10% increments
    - b. Time Delay – Fixed (1-30 minutes in 1 minute increments), and automatic
    - c. Test mode – Five second time delay
    - d. PIR, Ultrasonic or Dual Technology activation and/or re-activation.
    - e. Walk-through mode
    - f. Load parameters including auto/manual ON, blink warning, and daylight enable/disable.
  - 2. RJ-45 digital connections for local network.
  - 3. Two-way infrared communications port to allow remote programming through hand held commissioning tool.
  - 4. Self-contained push buttons for programming and control of room devices.
  - 5. Device Status LED's including:
    - a. PIR Detection
    - b. Ultrasonic detection
    - c. Configuration mode
    - d. Load binding
  - 6. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
- C. Units will provide for digital calibration and commissioning and will not have any dip switches or potentiometers for field settings
- D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology local network. No additional configuration will be required.



## 2.05 LIGHTING CONTROLLERS

- A. Lighting Controllers automatically bind the room loads to the connected devices in the space without any tools or configuration requirements. Controllers shall be provided to match the room lighting load and control requirements and sequences. The controllers will be simple to install and will not have screw type connections, dip switches, potentiometers or require special mounting or configuration. The control units will include the following features:
1. Automatic room configuration to the most energy efficient sequence of operation based upon the devices in the room.
  2. One or two relay configuration.
  3. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an Off-the-Shelf unit without requiring any configuration or setup.
  4. Device Status LED's to indicate:
    - a. Data transmission
    - b. Device has power
    - c. Status for each load
    - d. Configuration status
  5. Quick installation features including:
    - a. Standard junction box mounting (inside or outside)
    - b. Quick low voltage connections using standard RJ-45 patch cable
  6. Plenum rated
  7. Manual override and LED indication for each load
  8. Universal voltage (120/230/277 VAC, 50-60 Hz)
  9. Zero cross circuitry for each load.
  10. Efficient 150 ma switching power supply
  11. Three RJ-45 local network ports
- B. 0-10 Volt enhanced Lighting Controllers shall include all the features of the Lighting Controller plus the following enhancements:
1. One, two or three relay configurations. See plans.
  2. Efficient 250 ma switching power supply
  3. Four RJ-45 local network ports.
  4. One zero to 10 volt analog output per relay for control of dimmable drivers.

## 2.06 ISOLATED RELAY INTERFACE

- A. Coordinate with Mechanical Contractor and BAS system provider the integration of HVAC zones with lighting control system. Refer to specification section 25 3516.
- B. Output only interface to interface digital lighting controller to third party system for occupant detection.
- C. The isolated relay interface shall include the following features:
1. Operating voltage: 24VDC.
  2. Relay ratings: 24 VDC/AAC, 1A, SPDT, NO, NC and commons outputs.
  3. Maximum current consumption: 7 mA.
  4. Overcurrent protection.
  5. Status LED for transmit and receive to allow connectivity verification.
  6. Indoor use only: 32°F to 104°F operation conditions.
  7. Fits a 4"x4" j-box.
  8. UL 2043 plenum rated.
  9. UL listed.

## 2.07 UL 924 EMERGENCY BYPASS/CONTROL DEVICES

- A. UL 924 listed bypass relays shall:
1. Be UL924 listed and labeled for connection to both normal and emergency lighting power sources.
  2. Have universal rated voltage inputs 120-277 VAC, 60 Hz.
  3. Have normally closed dry contacts rated for switching 120-277 volts, 60 Hz. 20 amp loads.
  4. Have integral manual test switch.
  5. Have auxiliary isolated normally closed contact for connection to remote test switch, fire alarm system, or other external system capable of providing a normally closed dry contact closure.
  6. Have status indication for presence of normal and emergency power sources and current operational mode (normal or emergency).
  7. Utilize zero crossing circuitry to protect relay contacts from the damaging effects of inrush current generated by switching electronic ballast loads.
  8. Be forced into the emergency mode upon loss of normal power sense and turn ON the emergency lighting.
  9. Automatically switch emergency lighting ON/OFF as normal lighting is switched. When normal power is not available, the unit shall force and hold emergency lighting ON regardless of the state of any external control device until normal power is restored.
- B. Operational temperature range shall be -40°F to 140°F.
- C. Device shall have universal mounting; surface, above suspended ceiling or recessed.

## 2.08 EXTERIOR PHOTOCELLS

- A. Photocells shall:
1. Have universal rated voltage inputs 120-277 VAC, 60 Hz.
  2. Be rated for up to 2,000 watts.
  3. Have cadmium sulfide, 1" diameter cell.
  4. Have SPST normally closed contacts.
  5. Have a minimum delay of 3 minutes to prevent false switching.
- B. ON/OFF adjustment shall be done by moving light selector with range from 2 to 50 footcandles.
- C. Operational temperature range shall be -40°F to 140°F.
- D. Enclosure shall be die cast zinc, gasketed for maximum weatherproofing.
- E. Enclosure shall include positioning lug on top.
- F. Mounting shall be for 1/2" conduit nipple.

## 2.09 TIMECLOCKS

- A. Timeclocks shall:
1. Be multi-purpose, 7-day, 365-day advance single and skip a day, combination 2-channel electronic astronomical time clock with SPDT switching configuration.
  2. Have universal rated voltage inputs 120-277 VAC, 60 Hz.
  3. Be capable of programming in AM/PM or 24-hour format by jumper selection or digital setting, in one-minute resolution, using 2 buttons for basic settings.

4. Have 365-day and/or holiday selection capabilities, with 16 single date and 5 holiday selection options and user selectable daylight savings/standard time functions.
  5. Have 72-hour memory backup with rechargeable battery and charger.
  6. Have manual override, ON/OFF to the next scheduled event, using one button for each channel.
  7. Have operational temperature range of -40°F to 150°F.
  8. Have a maximum allowed over-ride period no greater than 2 hours.
- B. Contacts shall be rated 10 amp resistive at 120/250 VAC, 7.5 amps inductive at 120/250 VAC, 5 amps inductive at 30 VDC and up to 1/2 hp at 250 VAC.
- C. Display shall be LCD type.
- D. Enclosure shall be rated for installation location.

## 2.10 FINISHES

- A. Color:
1. Wall box dimmers, low-voltage switches, occupancy sensors, and device cover plates: Stainless Steel Type 302/304, horizontal brushed finish.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Install devices at heights scheduled, and as indicated on drawings.
- B. Install wall devices vertically on latch side of door within 6" of frame edge, unless otherwise noted.
- C. Install ceiling devices as shown on drawings and as recommended by device manufacturer.
- D. Ceiling mounted occupancy sensors shall be located minimum of 6 ft from supply air diffusers.
- E. Install devices plumb, level with finished surfaces and free from blemishes.
- F. Verify device locations prior to rough in.
- G. Control wiring shall be low voltage, Class II wiring, electrically isolated from power wiring by a Class II transformer.
- H. Provide separate neutral conductor for each dimmer.
- I. Wiring shall be in conduit.
- J. Electrical Contractor shall be responsible for final adjustment and testing of all devices.

### 3.02 TESTING

- A. Verify proper location and operation of all devices.
- B. Verify dimmers function without:
1. Producing lamp flicker or audible noise.
  2. Interference of audio and visual equipment.
- C. Adjust occupancy sensors for a 30 minute time delay.

- D. Adjust occupancy sensor sensitivity such that movement outside range of coverage shall not trigger sensor.

END OF SECTION

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SECTION 26 27 26 - WIRING DEVICES

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems
- B. Section 26 0553 - Electrical Systems Identification

1.02 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.03 DESCRIPTION

- A. Section includes general-use snap switches, wall-box dimmers, fan speed controls, receptacles, pendant cord-connector devices, cord and plug sets and device cover plates.

1.04 REFERENCE STANDARDS

- A. IEEE C62.41.2 – Characterization of Surges in Low-Voltage (1000V and less) AC Power Circuits
- B. IEEE C62.45 – Surge Testing for Equipment Connected to Low-Voltage (1000V and less) AC Power Circuits
- C. NECA 1 – Good Workmanship in Electrical Contracting
- D. NFPA 70 – National Electrical Code
- E. NEMA FB 11 – Plugs, Receptacles, and Connectors of the Pin and Sleeve Type for Hazardous Locations
- F. NEMA WD-1 – General Color Requirements for Wiring Devices
- G. NEMA WD-6 – Wiring Devices - Dimensional Requirements
- H. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum)
- I. UL 20 – General-Use Snap Switches
- J. UL 498 – Attachment Plugs and Receptacles
- K. UL 943 – Ground-Fault Circuit-Interrupters
- L. UL 1010 – Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations
- M. UL 1436 – Outlet Circuit Testers and Similar Indicating Devices
- N. UL 1917 – Solid-State Fan Speed Controls

1.05 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Manufacturer's Installation Instructions:
  - 1. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- D. Test Reports: Indicate field test and inspection procedures and interpret test results and corrective action taken for compliance with specification requirements.
- E. Closeout Submittals:
  - 1. Project Record Documents:
    - a. Record actual locations and ratings of wiring devices.
  - 2. Operation and Maintenance Data:
    - a. Include in manufacturers' packing label warnings and instruction manuals with labeling conditions.
    - b. Include source and current prices of replacement parts and supplies.

#### 1.06 QUALITY ASSURANCE

- A. Obtain wiring devices from one source and by single manufacturer.
- B. Regulatory Requirements:
  - 1. Comply with NFPA 70 for components and installation.
  - 2. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in clean, dry space. Maintain factory unopened packaging until ready for installation.

#### 1.08 WARRANTY

- A. Refer to Division 01 and Section 26 0000 – General Electrical Requirements for general warranty requirements.
- B. Manufacturer shall provide standard 1 yr warranty against defects in materials and workmanship for products specified in this Section. Warranty period shall begin on date of final acceptance.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Cooper Wiring Devices; a division of Cooper Industries, Inc.
- B. Hubbell Incorporated; Wiring Device-Kellems
- C. Leviton Manufacturing Company, Inc.
- D. Pass & Seymour/Legrand; Wiring Devices & Accessories

## 2.02 GENERAL-USE SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches: Heavy-duty (specification grade); back and side wired; flush or surface mounting; Body and Handle: thermoplastic with toggle handle; for connection to copper or copper-clad conductors:
  - 1. Ratings:
    - a. Voltage: 120-277V, AC
    - b. Current: 20 A
  - 2. Single pole
  - 3. Double pole
  - 4. Pilot Light: Indicator light switch (single pole with green neon-lighted handle, illuminated when switch is "ON.")
  - 5. Locking Type: Designed to prevent tampering and unauthorized switching.
  - 6. Key-Operated: Single pole, with factory-supplied key in lieu of switch handle.
  - 7. Single-Pole, Double-Throw, Momentary Contact, Center-Off: For use with mechanically held lighting contactors.
  - 8. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off: For use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
  - 9. Weatherproof: Toggle switch

## 2.03 MOTOR RATED SWITCH

- A. Switches: Heavy-duty (specification grade), HP rated, 20A, 120-277V. two-position, single throw. Lockable. UL 508 listed.

## 2.04 RECEPTACLES

- A. Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
- B. Receptacles: 125 V, 20A, heavy-duty (specification grade); back and side wired; flush or surface mounted; straight blade; 2 pole, 3 wire grounding; thermoplastic body; duplex and single as indicated on drawings.
  - 1. Ground Fault Circuit Interrupter (GFCI):
    - a. Additional compliance with UL 943 Class A.
    - b. Leakage current trip level: 4 to 6 mA.
    - c. Trip time: .025 seconds nominal.
    - d. Feed-through type
    - e. Reverse line-load function to prevent GFCI from functioning if wired incorrectly.
    - f. Indicator Light: Lighted when device is tripped.
  - 2. Isolated Ground (IG):
    - a. Ground strap isolated from mounting strap.
    - b. Ground screw connected directly to ground contacts.
  - 3. Twist-locking:
    - a. NEMA WD 6 configuration As indicated on drawings.
  - 4. Switched: Upper half switched and lower half not switched.
  - 5. Dedicated: Labeled "Dedicated."



6. Plug-Tail type devices are permissible where an angled connector is used and connector conductors have 6" of slack before splice into circuit.
7. Special Purpose Receptacles: Specification grade, rated for voltage, amperage and NEMA configuration as noted on drawings.

#### 2.05 PENDANT CORD-CONNECTOR DEVICES

- A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configuration L5-20P and L5-20R, heavy-duty grade.
  1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
  2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

#### 2.06 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
  1. Cord: Thermoset-insulated, stranded-copper conductors, with Type SOOW jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30%.
  2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

#### 2.07 DEVICE COVER PLATES

- A. Single and combination types to match corresponding wiring devices:
  1. Attachment: Metal screws with head color to match plate finish.
  2. Material for Finished and Unfinished Spaces: **brushed**-finished stainless steel.
  3. Material for Damp Locations: Cast aluminum with while-in-use hinged cover, and listed and labeled for use in "wet locations".
- B. Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with weatherproof while-in-use hinged cover.

#### 2.08 FINISHES

- A. Color:
  1. Switch handles, receptacle faceplates, and device cover plates: gray, except as follows:
    - a. Switch handles and receptacle faceplates connected to Emergency or Standby Power System: Red; labeled "Emergency."

### PART 3 EXECUTION

#### 3.01 COORDINATION

- A. Special Purpose Receptacles: Coordinate final selections of NEMA configuration (locking, straight, blade, etc.) with configuration of plug on utilization equipment.
- B. Receptacles for Owner-furnished equipment and equipment furnished under other divisions of specifications: Match plug configurations.

- C. Cord and Plug Sets: Match equipment requirements.
- D. Coordination with Other Trades:
  - 1. Take steps to ensure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers guided by riding against outside of the boxes.
  - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  - 3. Install device boxes in brick or block walls so that the device cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  - 4. Install wiring devices after all wall preparation, including painting, is complete.

### 3.02 EXAMINATION

- A. Verify location of wiring devices with architectural interior elevation drawings, prior to rough-in.
- B. Verify outlet boxes are installed at proper height.
- C. Verify wall openings are neatly cut and completely covered by wall plates.
- D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

### 3.03 PREPARATION

- A. Clean debris from outlet boxes.

### 3.04 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise scheduled or indicated on drawings. Indicated dimensions are to center of device.
- B. Conductors:
  - 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
  - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  - 3. Length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
  - 4. Do not place bare stranded conductors directly under device screws. Use crimp on fork terminals for device terminations.
- C. Device Installation:
  - 1. Replace all devices that have been in temporary use during construction or show signs of installation prior to completion of building finishing operations.
  - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  - 3. Do not remove surface protection, such as plastic film and smudge covers, until last possible moment.
  - 4. Connect devices to branch circuits using pigtails that are not less than 6" in length.
  - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.

6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
  7. When conductors larger than #12 AWG are installed on 15A or 20A circuits, splice #12 AWG pigtails for device connections.
  8. Tighten unused terminal screws on the device.
  9. When mounting into metal boxes, remove fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
  10. Install devices plumb, level with finished surfaces and free from blemishes.
  11. Install lighting switches vertically on latch side of door within 6" of frame edge.
  12. Install devices above counters, 2" to the bottom of device above countertop or backsplash. Install all devices at same height above any one counter or fixed cabinet.
  13. Install special purpose receptacles and switches according to shop and rough-in drawings furnished by trade(s) producing such equipment. Verify locations prior to rough-in.
  14. Install weatherproof GFCI receptacles:
    - a. Within 25'-0" of roof-mounted mechanical equipment
    - b. Outdoors
    - c. As indicated on drawings
  15. Group adjacent switches under single, multigang wall plates.
  16. Connect wiring device grounding terminal to outlet box with bonding jumper. Ground per requirements in Section 26 0526 – Grounding and Bonding for Electrical Systems.
- D. Installation Orientations:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
  2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.
  3. Install switches with handle operating vertically, with "ON" position up.
  4. Unless otherwise indicated or where space problem occurs, mount devices flush, with long dimension vertical.
- E. Device Cover Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- F. Wall-Box Dimmers:
1. Install dimmers within terms of their listing.
  2. Verify that dimmers used for fan speed control are listed for that application.
  3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- G. Arrangement of Devices:
1. Unless otherwise indicated or where space problem occurs, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

### 3.05 IDENTIFICATION

- A. Comply with Section 26 0553 – Electrical Systems Identification.
1. Switches and Receptacles: Use hot, stamped or engraved machine printing with black-filled lettering on face of cover plate, and durable wire markers or tags inside outlet boxes.

- a. Receptacles: Label shall indicate receptacle voltage, phase, and amperage for receptacles other than 20A, 120 V, at top of cover plate, and panel and circuit number at bottom of cover plate.
  - b. Switches: Label shall indicate switch voltage, phase, and amperage at top of cover plate, and panel, circuit number and switch designation at bottom of cover plate.
2. Engrave cover plates on all Owner-furnished equipment and equipment furnished under other divisions of these specifications with panelboard, circuit number and “emergency” (where applicable) as specified in this section. This includes headwalls, gas columns and booms, patient consoles, medical rail systems, custom casework with electrical devices, etc.

### 3.06 FIELD QUALITY CONTROL

- A. Inspect wiring devices for defects.
- B. Operate wall switches with circuits energized and verify proper operation.
- C. Verify receptacle device is energized.
- D. Perform tests and prepare test reports:
  1. Test receptacle devices for proper polarity:
    - a. Test every receptacle with receptacle circuit tester. Tester shall test for open ground, reverse polarity, open hot, open neutral, hot and ground reversed, hot or neutral and hot open. Rewire receptacles with faults and retest.
  2. Test each GFCI receptacle device for proper operation:
    - a. Perform testing using an instrument specifically designed and manufactured for testing ground-fault circuit interrupters. Apply the test to the receptacle. “TEST” button operation will not be acceptable as a substitute for this test. Replace receptacles that do not shut off power with 5/1000 A within 1/40 second and retest.
  3. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
  4. Test Instruments: Use instruments that comply with UL 1436.
  5. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- E. Tests for Convenience Receptacles:
  1. Line Voltage: Acceptable range is 105 V to 132 V.
  2. Percent Voltage Drop under 15A Load: A value of 5% or higher is not acceptable.
  3. Ground Impedance: Values of up to 2 ohms are acceptable.
  4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  5. Using the test plug, verify that the device and its outlet box are securely mounted.
  6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- F. Operational Tests: Demonstrate the operation of each switch with the systems fully energized and operating. Each switch shall be demonstrated three times.
- G. Interpret test results in writing and submit to Engineer.

### 3.07 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.08 CLEANING

- A. Remove excess plaster from interior of outlet boxes.
- B. Clean devices and cover plates after painting is complete. Replace stained or improperly painted devices and cover plates.

END OF SECTION

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 26 0519 – Low-Voltage Electrical Power Conductors and Cables
- B. Section 26 0526 – Grounding and Bonding for Electrical Systems
- C. Section 26 0529 – Hangers and Supports for Electrical Systems
- D. Section 26 0548 – Vibration and Seismic Controls for Electrical Systems
- E. Section 26 0553 – Electrical Systems Identification

1.02 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.03 DESCRIPTION

- A. Section includes fusible and non-fusible disconnect switches and circuit breakers in individual enclosures.

1.04 REFERENCE STANDARDS

- A. ANSI//NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting
- B. NEMA AB 1 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breakers Enclosures
- C. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
- D. NFPA 70 - National Electrical Code
- E. UL 98 - Enclosed and Dead Front Switches
- F. UL 486A - 468B - Wire Connectors
- G. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures
- H. UL 869A - Reference Standard for Service Equipment

1.05 SUBMITTALS

- A. Product Data:
  - 1. Submit catalog cut sheet indicating voltage, amperage, HP ratings, enclosure type, and dimension, fuse clip features, terminal lugs and all accessories including interlock devices, short circuit current ampere rating and factory settings of individual protective devices.
- B. Manufacturer's Installation Instructions:

1. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- C. Test Reports:
1. Indicate field test and inspection procedures and interpret test results and corrective action taken for compliance with specification requirements.
- D. Closeout Submittals:
1. Project Record Documents:
    - a. Record actual locations of disconnect switches and ratings of installed fuses.
    - b. Record actual locations and continuous current ratings of enclosed circuit breakers.
  2. Operation and Maintenance Data:
    - a. Include manufacturer's recommended operating instructions, maintenance procedures and intervals, and preventive maintenance instructions.
    - b. Include spare parts data listing, source, and current prices of replacement parts and supplies.
    - c. Include Manufacturer's Seismic Qualification Certification and Installation Seismic Qualification Certification.

#### 1.06 QUALITY ASSURANCE

- A. Obtain disconnect switches and enclosed circuit breakers from one source and by single manufacturer.
- B. Regulatory Requirements:
1. Comply with NFPA 70 for components and installation.
  2. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.
- C. Certifications:
1. Furnish Engineer with Manufacturer's Seismic Qualification Certification: Submit certification that disconnect switches and enclosed circuit breakers, accessories, and components will remain physically intact to withstand seismic forces defined in Section 26 0548 – Vibration and Seismic Controls for Electrical Systems. Include the following:
    - a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
  2. Furnish Engineer with Installation Seismic Qualification Certification: Submit certification that disconnect switches and enclosed circuit breakers, accessories, and components will remain in place without separation of any parts when subjected to the seismic forces defined in Section 26 0548 – Vibration and Seismic Controls for Electrical Systems. Include the following:
    - a. Detailed description of disconnect switches and enclosed circuit breakers anchorage devices and seismic restraints on which the certification is based and their installation requirements.
    - b. Certification shall bear the seal and signature of an Engineer registered and licensed in the State of North Carolina.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect from dirt, water, construction debris, and traffic.

- B. Comply with manufacturer's written instructions.

#### 1.08 WARRANTY

- A. Refer to Division 01 and Section 26 0000 – General Electrical Requirements for general warranty requirements.
- B. Manufacturer shall provide standard 1 yr written warranty against defects in materials and workmanship for products specified in this Section. Warranty period shall begin on date of substantial completion.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Schneider Square D
- B. ABB-GE Industrial Solutions
- C. Eaton Cutler-Hammer
- D. Siemens

#### 2.02 DISCONNECT SWITCHES

- A. NEMA KS 1, UL 98
- B. Load interrupter enclosed knife switch, heavy-duty type.
- C. Fusible or non-fusible type as indicated.
- D. Switch Interiors:
  - 1. Switch blades that are visible in "OFF" position when switch door is open.
  - 2. Plated current carrying parts.
  - 3. Removable arc suppressors to permit easy access to line side lugs.
- E. Switch Mechanism:
  - 1. Quick-make, quick-break, with visible blades and externally operable handle.
  - 2. Lockable only in "OFF" position and accept three industrial type, heavy-duty padlocks.
  - 3. Dual cover interlock to prevent unauthorized opening of switch door when handle is in "ON" position, and to prevent closing of switch mechanism with door open.
  - 4. Defeater mechanism to bypass interlock.
  - 5. Operating handle integral part of enclosure.
  - 6. Handle to physically indicate "ON" and "OFF" position.
- F. Ratings:
  - 1. Ampacity as indicated on drawings.
  - 2. Horsepower rated.
- G. Fusible Switches:
  - 1. Rejection clips for Class R fuses specified.
  - 2. Provisions for Class J or Class L fuses, as applicable.



H. Fuses:

1. NEMA FU 1, UL 248-1.
2. Motor circuits: Class RK5.
3. Other Branch Circuits: Cass J.
4. Size as indicated on drawings. Coordinate recommended size with protected equipment contractor and manufacturer.

2.03 ENCLOSED CIRCUIT BREAKERS

A. NEMA AB 1, UL 489.

B. Enclosed molded-case circuit breakers:

1. Tripped indication clearly shown on breaker handle taking position between “ON” and “OFF”.
2. 225A frame size and below: thermal-magnetic trip.
3. 250A frame size and above: electronic (solid-state microprocessor-based) trip units interchangeable in the field within the frame size and field-adjustable long time pick-up, and instantaneous current settings. Each adjustment shall have discrete settings and shall be independent of other adjustments.
4. Locks on trip handles where indicated.

C. Breaker Mechanism:

1. Quick-make, quick-break.

D. Ratings:

1. Ampacity as indicated on drawings.
2. Listed as Type HACR for air conditioning equipment circuits.
3. Listed as Type SWD for lighting circuits.

2.04 LUGS

A. Front removable lugs.

B. Labeled for 75°C copper and aluminum conductors.

C. Multiple lugs to match number of conductors per phase.

D. Termination of field installed conductors: Pressure wire connectors, except wire-binding screws for #10 AWG or smaller conductors.

2.05 ACCESSORIES:

A. Solid neutral assembly, where required.

B. Equipment ground kit.

C. Blown fuse indicators on fused disconnect switches.

D. Factory installed fuse puller on fused disconnect switches.

2.06 ENCLOSURES

A. NEMA KS 1, NEMA AB 1, UL 98, UL 489, as applicable.

B. NEMA Type 1, Type 3R (outdoor locations) enclosure.

- C. Code-gauge galvanized steel.
- D. Manufacturer's standard gray enamel finish over prime coat.
- E. Surface-mounted.

#### 2.07 SHORT CIRCUIT CURRENT RATING

- A. Each circuit breaker shall have minimum short circuit current rating as indicated on drawings.

### PART 3 EXECUTION

#### 3.01 COORDINATION WITH MANUFACTURER

- A. Instruct manufacturer about the location of incoming lugs, i.e., top or bottom feed based on incoming feeder entrance location.
- B. Verify that "touch-up" paint kit is available for repainting.

#### 3.02 EXAMINATION

- A. Examine areas and surface to receive disconnect switches and enclosed circuit breakers for compliance with requirements, installation tolerances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Verify that space indicated for disconnect switches and enclosed circuit breakers mounting meets code-required working clearances.
- C. Notify Architect/Engineer of any discrepancies prior to submittal of product data and shop drawings.

#### 3.03 INSTALLATION

- A. Install disconnect switches and/or enclosed circuit breakers in accordance with ANSI/NECA 1.
- B. Install disconnect switches and/or enclosed circuit breakers level and plumb, in accordance with manufacturer's written instruction.
- C. Disconnect switches and enclosed circuit breakers mounting and seismic restraints:
  - 1. Install disconnect switches and enclosed circuit breakers anchorage devices and seismic restraints based on design by an Engineer registered and licensed in the State of North Carolina, and to comply with Section 26 0548 – Vibration and Seismic Controls for Electrical Systems for seismic criteria.
  - 2. Fasten disconnect switches and enclosed circuit breakers firmly to walls and structural surfaces, ensuring they are permanently and mechanically anchored.
  - 3. Anchor and fasten disconnect switches and enclosed circuit breakers and their supports to building structural elements (wood, concrete, masonry, hollow walls and nonstructural building surfaces) by the methods described in Section 26 0529 – Hangers and Supports for Electrical Systems.
  - 4. Install two rows of steel slotted channel, with a minimum of four attachment points, for each disconnect switch and enclosed circuit breaker.
  - 5. When not located directly on wall, install support frame of steel slotted channel anchored to floor and ceiling structure.
- D. Do not support disconnect switches and/or enclosed circuit breakers by raceway.

- E. Install top disconnect switch and/or enclosed circuit breaker handle a minimum of 3'-6" and maximum of 6'-6" above finished floor.
- F. Tighten electrical connectors and terminals according to equipment manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A - 486B.
- G. Install engraved plastic nameplates under provisions of Section 26 0553 – Electrical Systems Identification. Attach nameplate to exterior of each switch and/or enclosed circuit breaker using small corrosion-resistant metal screws or rivets. Do not use contact adhesive.
  - 1. Include switch and/or enclosed circuit breaker name, amperage, voltage, phase, and number of wires.

#### 3.04 CONNECTIONS

- A. Ground equipment according to Section 26 0526 – Grounding and Bonding for Electrical Systems.
- B. Connect wiring according to Section 26 0519 – Low-Voltage Electrical Power Conductors and Cables.

#### 3.05 FIELD QUALITY CONTROL

- A. Inspect for physical damage, proper alignment connections, anchorage, and grounding.
- B. Correct malfunctioning units on-site and retest to demonstrate compliance. Remove and replace with new units and retest.

#### 3.06 REPAINTING

- A. Remove paint splatters and other marks from surface of equipment.
- B. Touch-up chips, scratches, or marred finishes to match original finish, using manufacturer-supplied paint kit. Leave remaining paint with Owner.

#### 3.07 ADJUSTING

- A. Circuit Breakers: Set field-adjustable trip settings or change the trip settings recommended by the manufacturer.

#### 3.08 CLEANING

- A. Vacuum dirt and construction debris from interior and exterior of equipment; do not use compressed air to assist in cleaning.

END OF SECTION

## SECTION 26 50 00 - LIGHTING

### PART 1 GENERAL

#### 1.01 RELATED WORK

- A. Section 26 0000 - General Electrical Requirements
- B. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables
- C. Section 26 0526 - Grounding and Bonding for Electrical Systems
- D. Section 26 0533 - Raceway and Boxes for Electrical Systems
- E. Section 26 0923 - Lighting Control Devices

#### 1.02 REFERENCE

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

#### 1.03 DESCRIPTION OF WORK

- A. Provide complete and fully operational lighting system per Contract Drawings and Specifications.
- B. Luminaires shall be provided complete with necessary accessories for proper installation.
- C. Catalog numbers shown in luminaire schedule are basic luminaire types. Additional features, accessories and options specified, scheduled or necessary for proper installation shall be included.
- D. Provide lamps for luminaires as recommended by luminaire manufacturer.
- E. Specifications and drawings convey the features and functions of luminaires only and do not show every item or detail necessary for the work.
- F. Work includes final aiming and focusing of luminaires under direction of the Architect/Engineer.

#### 1.04 REFERENCE STANDARDS

- A. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems (ANSI)
- B. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems (ANSI)
- C. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems (ANSI)
- D. NECA 503 – Standard for Installing Fiber Optic Lighting Systems
- E. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility
- F. UL 496 – Lampholders
- G. UL 924 - Emergency Lighting and Power Equipment
- H. UL 1598 – Luminaires
- I. UL 2388 – Flexible Lighting Products

- J. UL 2562 – Pendant Cable
- K. UL 8750 – LED Light Sources for use in Lighting Products
- L. ANSI C78.377 – Chromaticity
- M. IESNA LM-79 – Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products
- N. IESNA LM-80 - Approved Method: Testing Lumen Maintenance of LED Light Sources
- O. IESNA TM21-11 - Projecting Long Term Lumen Maintenance of LED Light Sources including Addendum A

#### 1.05 QUALITY ASSURANCE

- A. Luminaire and accessory components shall be constructed of materials appropriate for their use.
- B. Luminaires, ballasts, drivers, lamps and other components shall meet the requirements of all applicable State and Municipal codes and energy codes.
- C. Provide luminaires listed and labeled by UL or other testing lab acceptable to local jurisdiction for their indicated use and installation conditions.
- D. Contractor shall coordinate installation of lighting systems with all trades.
  - 1. Manufacturers listed in the luminaire schedule shall be assumed capable of supplying listed luminaires. Any such exceptions shall immediately be brought to the attention of Architect, Engineer.
  - 2. Multiple Name Specification:
    - a. When multiple manufacturers are listed, Electrical Contractor shall choose which of the listed products are to be provided.
    - b. Products of the same type shall be of same manufacturer.
  - 3. Single Name Specification:
    - a. When only one product is suitable for the application and/or no other known acceptable products exist, only one manufacturer/product is listed in the Luminaire Schedule. For such instances, Electrical Contractor shall provide the listed product with no exceptions.
    - b. Specifier has secured accurate pricing for all single name products prior to bidding and has shared this information with Architect/Owner's Representative. Contractor shall supply contractor net unit pricing for all single name products specified. Unit price shall be for equipment only and not include installation or miscellaneous electrical costs.
  - 4. Contractor shall coordinate and verify compatibility of luminaires with lighting control system
    - a. Control protocol indicated for luminaires matches protocol of lighting control system specified. Contractor shall coordinate and verify compatibility of all dimming luminaires with control system to ensure that dimming is flicker free, continuous dimming through the dimming range noted on the luminaire schedule.
- E. Substitution requests:
  - 1. Will be evaluated prior to Bid.
  - 2. Shall follow procedures set forth in this Section under paragraph 1.7 and in Section 01 2500 - Substitution Procedures.
  - 3. Shall be made not less than 10 days prior to bid date.

4. Shall include the following information indicating that the proposed substitution is of similar construction quality and assembly, lumen output and distribution, color temperature, color consistency, and controllability:
  - a. Specified and proposed manufacturer's product data sheet, noting options and features.
  - b. Provide dimensioned drawing of luminaire.
  - c. Provide photometric data in form of an electronic IES file on CD, USB or via email for use in a recognized computer lighting program.
5. Electrical Contractor shall be responsible for all costs incurred by substitution request sample and/or mockup production and review.
6. Equipment delivery lead time shall not be held as a valid reason for requesting luminaire substitution unless luminaire lead time from specified manufacturer is in excess of 14 weeks. It shall be sole responsibility of Electrical Contractor to determine necessary equipment lead times, deliver submittals for review in a timely fashion, and place orders accordingly to ensure timely delivery.
7. When requesting a substitution, Electrical Contractor shall provide unit and extended pricing for specified luminaire, unit and extended pricing for proposed alternate, and unit and extended delta savings to owner to be realized by accepting proposed alternate. If requested, provide unit pricing for each luminaire type specified to provide a baseline comparison for substitution request.
8. Electrical Contractor shall guarantee pricing on all luminaire types for which a substitution request has been granted. This price guarantee shall be per unit and shall be maintained through the end of construction, regardless of quantity purchased.
9. For all luminaire types using an LED light source, provide independently tested, IESNA LM79 compliant photometry testing data and IESNA LM-80 Lumen Maintenance data.

#### 1.06 WARRANTY

- A. Exit Signs Utilizing LED lamp Technology: Provide manufacturer's warranty for a period of not less than five years from the date of final acceptance including parts and labor for full replacement of defective product.
- B. LED Luminaires: Provide Manufacturer's warranty for a period of not less than five years from the date of final acceptance or the specified warranty period greater than five years for repair or replacement of defective electrical parts, including light source and driver

#### 1.07 SUBMITTALS

- A. After award of Contract, submit complete list of lighting products to be furnished, with manufacturer and catalog designations, including currently quoted lead times for product delivery. Should Electrical Contractor anticipate delivery schedule of any specified product may adversely impact construction schedule, they shall bring it to the attention of Owner/Architect at this time.
- B. In addition to complying with requirements of Section 26 0000 - General Electrical Requirements, submittals shall include the following:
  1. Manufacturer's product data
  2. Installation instructions
  3. Maintenance data
  4. Parts list for each luminaire accessory
  5. Photometric Data: photometric data for luminaire, including optical performance as follows:
    - a. Coefficients of utilization

- b. Luminance table
  - c. Candela distribution data
  - d. Zonal lumens
  - e. Area and roadway luminaires shall include Isocandela Charts, IES Roadway Distribution Classification and IES BUG (Backlight – Uplight – Glare) ratings.
6. Driver cut sheet for each driver used, referencing luminaire type(s)
  7. Lamp schedule indicating manufacturer, type, and catalog number for each luminaire
  8. Lamp cut sheet for each lamp used, referencing luminaire type(s)
  9. Documentation of lamp and ballast or LED and driver compatibility
  10. Product color/finish
    - a. Where specific finish or color is not specified and options exist, submit color or finish samples to Architect/Engineer for selection.
- C. Shop Drawings for equipment provided under this Section shall include the following:
1. Overall submittal drawings indicating luminaire size, mounting (including ceiling type), light source, shielding, and voltage attributes, as well as manufacturer's product data, installation instructions, maintenance data, and parts list for each luminaire.
  2. Catalog cutsheets lacking sufficient detail will not be accepted.
  3. Detailed drawings of linear pendant mounted and suspended luminaires including dimensions, support spacing, suspension type, power feed type and locations, lamp combinations, ballast/driver locations, wiring and controls configuration, luminaire joint locations and end plates. Provide canopy details that indicate coordination with the ceiling system provided.
  4. Detailed drawings for each cove and linear wall system configuration including dimensions, power feed locations, ballast or driver locations, luminaire joint locations, extension plates for end and corner sections and end plates.
    - a. For LED strip luminaires mounted in architectural coves, provide dimensioned drawings and sections and include accessory cut sheets as specified. Within coves, all luminaires are to be mounted end to end with no more than 12" unlit split evenly between ends
  5. Detailed drawings for LED systems including LED color, color consistency, rated life, warranty, and scale plans with luminaire layout, number, type and location for drivers, and a complete bill of materials.
  6. Detailed drawings for continuous recessed or continuous surface mounted LED or fluorescent luminaires including dimensions, power feed locations, ballast or driver locations/quantity, luminaire joint locations, extension plates for end and corner sections and end plates as applicable.
  7. Detailed drawings for custom LED handrail systems including dimensions, power feed locations, ballast or driver locations/quantity, luminaire joint locations as applicable.
  8. For LED luminaires, submit documentation that indicates specified products have been tested, or will be tested, for compatibility with the lighting controls being procured and will perform as specified. Control devices or system shall be able to control luminaires with flicker free, continuous dimming, in range specified. Electrical Contractor, luminaire manufacturer and lighting control manufacturer shall be financially responsible for any incompatibilities.
  9. Detailed drawings for nonstandard/custom luminaires indicating dimensions, weights, method of field assembly, components, features, and accessories. Details shall be scaled to a legible size.
  10. Detailed drawings for fiber optic systems including scaled plans with cable layout number and type of fiber bundles, illuminator quantity and location, and a complete bill of materials.

11. Drawings for site lighting shall include pole data with wind loading, complete dimensions and finish, pertinent physical characteristics and accessories including mounting details, ballast/driver type and location and any specified control options.
  12. Photometric Data: Where indicated on luminaire schedule and Contract Drawings, supply complete photometric data for luminaire, including optical performance rendered by independent testing laboratory developed according to methods of the Illuminating Engineering Society of North America as follows:
    - a. Coefficients of utilization
    - b. Luminance table with data presented numerically, showing maximum luminaire luminance at shielding angles. Readings should be taken both crosswise and lengthwise in case of fluorescent luminaire or luminaire with an asymmetric distribution.
    - c. Candela distribution data, presented graphically and numerically, in 5° increments (5°, 10°, 15°, etc.). Data developed for up and down quadrants normal, parallel, and at 11-1/2°, 45°, 67-1/2° to lamps if light output is asymmetric.
    - d. Zonal lumens stated numerically in 10° increments (5°, 15°, etc.) as above.
  13. No variation from the general arrangement and details indicated on drawings shall be made on shop drawings unless required by actual conditions. All variations shall be marked on drawings submitted for approval.
- D. Provide luminaires with factory or field finish as directed by Architect/Engineer. Verify final finish requirements before releasing luminaires for fabrication.
- E. Where specific finish or color is not specified and options exist, submit color or finish samples to Architect for selection. Luminaires not having color or finish acceptable to Architect shall be replaced at no additional cost.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

- A. Luminaires:
1. As shown on Luminaire Schedule
- B. LED Drivers:
1. Shall be manufacturer recommended compatible driver.
  2. All LED drivers shall be dimming type standard unless otherwise noted. Refer to construction documents for control per application.
  3. Manufacturers must be compatible with lighting control system(s) provided and control luminaires from 100% to 1% light output or 100% to 10% light output per Luminaire Schedule and controls intent documents.
- C. Emergency LED Drivers:
1. Bodine, Dual-Lite, Iota or as specified in the Luminaire Schedule
- D. LED Modules:
1. Philips Lumileds, Xicato, Cree, GE, Nichia, Osram Sylvania, Bridgelux, Citizen or as specified in the Luminaire Schedule

### 2.02 FABRICATION AND MANUFACTURER

- A. Luminaires:
1. Construction



- a. Luminaires shall bear label indicating circuit voltage. Labels shall not be visible from normal viewing angles.
  - b. Luminaires shall be constructed with joints made by means of welded, brazed, screwed, or bolted construction methods.
  - c. Housings shall be so constructed that all electrical components are accessible and replaceable without removing luminaires from their mountings.
  - d. Surface temperatures of luminaires with ballasts or integral drivers shall not exceed 90°C in 30°C ambient.
  - e. Luminaires recessed in ceilings utilized as air handling plenums shall be certified as suitable for the purpose and conform to NEC Article 300.
  - f. Miter cuts shall be accurate, joints shall be flush and without burrs.
  - g. Fluorescent and LED troffers with doors shall have spring-loaded door cam latches.
  - h. Luminaires shall be free of light leaks and designed to provide sufficient ventilation of lamps to provide the photometric performance documented. Ballasts, low voltage transformers and drivers shall be vented per manufacturer's specifications.
  - i. Provide inscription for exit and stairway signs to conform to applicable codes.
  - j. Verify types of ceiling construction with General Contractor prior to releasing luminaires for fabrication and delivery and provide luminaires adapted to ceiling construction used.
  - k. Coordinate recessed luminaire mounting appurtenances, flanges and trims with construction of ceiling in which luminaire is to be recessed. Provide correct luminaire mounting assembly.
  - l. Luminaire frames shall be manufactured of non-ferrous metal or be suitably rust proofed after fabrication.
  - m. For all Luminaires types using an LED light source, provide luminaires listed on one of the following websites: LED Lighting Facts website ([www.lightingfacts.com](http://www.lightingfacts.com)), Energy Star website ([www.energystar.gov](http://www.energystar.gov)), or the Design Light Consortium website ([www.designlights.org](http://www.designlights.org)).
2. LED Luminaires are considered a lighting system with dependent components that must be evaluated as a complete system. Each LED luminaire includes a light emitting source, provisions for heat transfer, electrical control, optical control, mechanical support and protection, as well as aesthetic design elements. All LED luminaires shall:
- a. Be UL listed or equivalent. Where remote drivers are specified, all drivers shall also have UL listing or equivalent and comply with code requirements.
  - b. Be tested to IESNA LM-79-08 testing using absolute photometry criteria.
  - c. Be rated at > or = to 70% lumen maintenance at 50,000 hours of operation.
  - d. Be rapid cycle stress tested.
  - e. Have integral lamp modules with a minimum operating temperature of -20°C.
  - f. Have lamp modules that are capable of being easily replaced upon failure with a manufacturer provided replacement module without voiding the UL listing of the luminaire.
  - g. Have driver housings easily accessible for ease of maintenance.
  - h. Have a maximum operating temperature at LED junction to not exceed 90°C over the expected operating range of the luminaire.
  - i. Be RoHS compliant, lead and mercury free.
  - j. Have an LED operating frequency of + or – 120 Hz.
  - k. Must meet the appropriate Federal Communications Commission (FCC) requirements for FCC 47 CFR 15 (consumer use) and/or FCC 47 CFR Part 18 (industrial use)
  - l. Be Class A Sound rated.

- m. Be supplied with power supply that complies with IEEE C. 62.41-1991.
  - n. Operate at 120 or 277 volts,  $\pm 10\%$ .
  - o. Have reverse polarity protected at all hardwired connections and have high voltage protection in the event connections are reversed or shorted during the installation process.
3. Lenses, Reflectors and Diffusers
- a. All lenses or louvers shall be removable, but held so that normal motion will not cause them to drop out.
  - b. All glass used in LED luminaires shall be made from thermal shock resistant borosilicate glass.
  - c. Optical lenses shall be free from spherical and chromatic aberrations.
  - d. Acrylic lenses shall be 100% virgin acrylic material.
  - e. Diffuser materials shall be UV stabilized in applications exposed to sunlight.
  - f. LED troffer lenses shall be 0.125" thick, unless otherwise noted.
  - g. Alzak reflectors and louvers shall be low iridescent equivalent to Coil Anodizers. All Alzak parabolic cones shall be guaranteed against discoloration for a minimum of ten years.
  - h. Reflector cones shall not have visible lamp flashing in the cone.
4. Optics and Adjustments
- a. Lamp holders shall be suitable for the indicated lamps and shall be set such that lamps are positioned in optically correct relation to all luminaire components.
  - b. Adjustable Angle Luminaire: Luminaires with adjustment beam angle shall contain reliable angle locking devices.
5. Finishes
- a. Provide luminaires with finish as shown in the luminaire schedule. Verify final finish requirements before releasing luminaires for fabrication.
  - b. Painted luminaires shall be painted after fabrication or "post painted".
  - c. Ferrous parts and supports shall be rust proofed after fabrication.
  - d. For weatherproof or vaportight installations, painted finishes of luminaires and accessories shall be weather resistant using proper primers or galvanized and bonderized epoxy, so that entire assembly is completely corrosion resistant for service intended and rated for an outdoor life expectancy of not less than 20 years.
6. Wiring
- a. Luminaires shall be completely wired at the factory and as required by code.
  - b. Internal wiring shall contain no splices.
  - c. Connections shall be made with insulated "wire nut" type mechanical connectors except that ballast and driver connections shall comply with NEC Article 410.
  - d. Wire for connections to lamp sockets and lamp auxiliaries shall be minimum #16 AWG luminaire wire.
  - e. Luminaires shall be provided with flexible conduit, pigtails, and equipment for external connections.
  - f. Recessed luminaires installed in inaccessible ceilings shall be UL listed for through wiring with the junction box accessible from the luminaire opening.
  - g. Provide dual-level switching for luminaires as indicated on luminaire schedule and/or where shown on Contract Drawings. Typically first switch designation controls outboard lamps, and second switch designation controls inboard lamp(s), unless noted otherwise.
  - h. Provide lamps for all luminaires.

7. Ceiling Coordination

- a. Verify type of ceiling construction prior to releasing luminaires for fabrication and delivery.
- b. Provide mounting appurtenance, flanges, sloped ceiling adaptors where required.
- c. Provide mounting assembly, clips or other mechanical mounting lugs as required for support of luminaires.

2.03 LED DRIVERS

A. LED Drivers and Power Supplies shall:

1. Operate system LEDs within the current limit specification of the LED manufacturer.
2. Be supplied with over-temperature protection circuitry.
3. Be programmable to allow for LED replacement modules to be “tuned” to match the output of remaining adjacent modules in the event that some time has passed and there has been lumen depreciation.
4. Be within a NEMA enclosure.
5. Be equipped with knockouts to accommodate standard conduit sizes
6. Have a Power Factor to be = or > than 0.9
7. Have a Lamp Current Crest Factor < 1.5
8. Dimmable LED drivers must be compatible with dimming system(s) provided and control luminaires per luminaire schedule and controls documentation.
9. ETL certified, CBM and UL Listed, high power factor, and meet or exceed NEMA and ANSI Standards.
10. Class A sound rated
11. Equipped with resetting thermal sensitive device.
12. For operation at 60 Hz and voltage as scheduled.
13. Meet or exceed all ANSI or NEMA standards
14. Capable of operating LEDs with less than 5% flicker
15. Be DMX compatible in Color changing LED luminaires.

B. Emergency LED Drivers shall:

1. Be UL 924 listed
2. Operate LED luminaire at 10W minimum output for 90 minutes
3. Have high temperature nickel-cadmium battery. Field replaceable
4. Be installed inside luminaires
5. Have solid state charging
6. Battery to be recharged within 24 h
7. Remote battery test switch.

C. All luminaires shall have a minimum 2.0 kV surge suppression approved by the manufacturer installed in-line with the driver.

2.04 LAMPS

- A. Provide lamps as noted on Luminaire Schedule.
- B. Provide lamps of same type from same manufacturer.

- C. Where a specific lamp manufacturer has been indicated in the Luminaire Schedule, lamps shall be supplied from named manufacturer only.
- D. White LED sources shall be:
  - 1. Minimum CRI of 85 unless noted otherwise on Luminaire Schedule
  - 2. Less than 5% flicker
  - 3. Within 0.004 on the CIE 1976 diagram for color spatial uniformity
  - 4. Within 0.007 on the CIE 1976 diagram for color maintenance over the rated lifetime of the source
  - 5. Binned within a 3-step MacAdam ellipse minimum, or as indicated in Luminaire Schedule
  - 6. Color temperature as noted on Luminaire Schedule
  - 7. Have a published life rating based on the point at which LED sources reach L70 lumen maintenance and tested in accordance with IES LM80-08 Approved Method: Testing Lumen Maintenance of LED light sources and IES TM-21-11: Projecting Long Term Lumen Maintenance of LED Light Sources
  - 8. L70 rated life shall be a minimum of 50,000 hours.
  - 9. LED modules, unless noted otherwise, shall be provided by light fixtures manufacturer and integral to luminaire.
- E. Provide all other lamp types and special purpose lamps as noted on Luminaire Schedule.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Marking:
  - 1. Voltage identification: Luminaires designed for voltages other than 110-125 volt circuits shall be clearly marked with rated voltage.
  - 2. Lamp/ballast coordination: Luminaires equipped with ballast for operation of rapid start lamps shall be plainly marked "Use Rapid Start Lamps Only". Similarly, luminaires equipped with ballasts or other components requiring use of specific types of lamps shall be plainly marked.
  - 3. Markings must be clear and shall be located to be readily visible to service personnel but invisible from normal viewing angles when lamps are in place.
- B. Installation of Luminaires:
  - 1. Lamps, glassware, reflectors and refractors shall be clean and free of chips, cracks and scratches.
  - 2. Install decorative luminaires, reflector cones, baffles, aperture plates, lenses, trims, and decorative elements of recessed luminaires after completion of ceiling tile, plastering, painting, and general cleanup is completed. Where luminaire location or construction does not permit sequential installation, all reflectors, lenses, flanges and other visible surfaces shall be carefully protected.
  - 3. Light leaks between ceiling trim of recessed luminaires and ceiling are not allowed.
  - 4. Locations
    - a. Install luminaires at locations and heights as indicated.
    - b. Do not scale electrical drawings for locations of luminaires.
    - c. Architectural reflected ceiling plans show locations of luminaires.

- d. Where noted on the drawings, the exact location of luminaires shall be confirmed (in the field) with the Architect/Engineer prior to installation.
  - e. Where luminaires are to be concealed, or surface mounted in highly visible public spaces, a small sampling of luminaires shall be installed, adjusted and aimed for Architect/Engineer's review approval, prior to installing remaining luminaire of same type.
  - f. Mount all luminaires so as to maintain full range of motion.
  - g. Install luminaires plumb, square, and level with ceilings and walls.
  - h. Coordinate stem, rod, chain, or aircraft cable hanger lengths with job conditions. Provide extra length of adjustable supports where diffusers are mounted directly above light fixtures to facilitate air balancing efforts.
  - i. Industrial type luminaires in unfinished areas, which are near obstructions such as ducts and pipes, shall be:
    - 1). Suspended so that bottom of luminaire is no higher than bottom of obstruction
    - 2). Located at height of lowest luminaire
    - 3). Minimum height: 8'-0"
    - 4). Shall not be located until locations of obstructions are determined.
    - 5). Where a minimum height of 8'-0" is unachievable, wall mounted luminaires will be utilized.
5. Support
- a. Support surface mount luminaires from building structure.
  - b. Metal decking shall not be pierced for luminaire support.
  - c. Provide luminaires and/or luminaire outlet boxes with hangers to support luminaire weight.
  - d. Fluorescent and LED troffers shall be held in place by support clips.
  - e. Provide plaster frames for recessed luminaires in plaster ceilings.
  - f. Rigid metallic pipe stems shall be utilized for the support of pendant mounted luminaires, unless otherwise noted.
  - g. Stem hangers shall be equipped with aligner box covers or canopies so that stems hang vertically, irrespective of the angle of the surface they are mounted from.
  - h. Wherever a luminaire or its hanger canopy is attached to a surface mounted outlet box, a finishing ring shall conceal the outlet box.
  - i. Yokes, brackets and supplementary supporting members needed to mount luminaires to suitable ceiling members shall be furnished and installed by Contractor. Verify mounting hardware required prior to installation.
  - j. Recessed luminaires shall be supported with 12 ga wire hangers, 2 per luminaire, at diagonally opposite corners.
  - k. Recessed fluorescent and LED troffers and luminaires over 55 lbs, such as 4' x 4' shall be supported with 12 ga wire hangers, 4 per luminaire, 2 at 45 degree diagonals, and two perpendicular to structure. Wire hangers and attachment to structure shall be capable of supporting 4 times luminaires weight.
  - l. In areas with seismic requirements, suspended or pendant mounted luminaires shall be able to swing 45 degrees in any direction without hitting an obstruction. In the event hitting an obstruction is unavoidable, guy wires will be used to secure the luminaire in place.
  - m. Surface luminaires installed in grid ceilings shall be supported by independent support clips and 12 ga wire. Secure luminaires to ceiling grid with screws at the four corners.

- n. Exit signs installed in grid ceilings shall be supported by electrical box hanger and additional 12 ga wire installed from box to structure.
  - o. Support surface mounted luminaires greater than 2 ft in length at a minimum of each additional 2 ft, or as recommended by manufacturer.
  - p. Brace suspended luminaires installed near ducts or other constructions with solid pendants or threaded rods.
  - q. Rigidly align continuous rows of luminaires.
  - r. Luminaire types with remote mounted ballast shall have:
    - 1). Proper support for ballast weight.
    - 2). Mounting distance from remote ballast to luminaire per manufacturer's recommendations.
6. Mounting and Enclosures
- a. Install flush mounted luminaires to eliminate light leakage.
  - b. For luminaires mounted adjacent to insulation, provide barrier to prevent insulation from coming in contact with luminaire, unless luminaire is approved for installation in contact with such insulation.
  - c. Provide approved fire rated enclosures around luminaires in fire rated ceilings.
7. Conduit and Wiring
- a. Wire for connections to lamp sockets and auxiliaries shall be suitable for temperature, current, and voltage conditions.
  - b. Recessed luminaires shall have final connections made with flexible metal conduit, not in excess of 72", with THHN conductors and green wire ground conductor.
  - c. Conduit shall be hidden from normal view in all possible cases. In public areas where surface mounted conduit must be used, contractor shall install conduit as unobtrusively as possible. Contractor shall obtain field approval by the architect for all exposed conduit runs prior to rough in.
- C. Lamps:
- 1. Provide new lamps delivered in original manufacturer's cartons.
  - 2. Fluorescent, LED and metal halide lamps shall be energized continuously for not less than 100 hours for proper seasoning.
- D. Grounding:
- 1. Ground luminaires and metal poles according to Division 26 Section "Grounding and Bonding for Electrical Systems".
- 3.02 FINAL ACCEPTANCE
- A. Quality Control:
- 1. At Date of final acceptance, replace lamps/LED modules/LED luminaires which are not operating properly.
  - 2. Replace any lamps used as worklights during construction phase.
  - 3. Protection wrapping on lensed or louvered luminaires shall be removed before installation of furniture, but after finish work is complete.
  - 4. Deliver spare equipment to Owner's representative.
- B. Tests:
- 1. Give advance notice of dates and times for field tests.
  - 2. Provide instruments to make and record test results.

3. Verify normal operation of each luminaire after luminaires have been installed and circuits have been energized.
  4. Verify operation of luminaires with lighting control system and daylight harvesting systems. Any dimmed fixtures shall exhibit no signs of flickering.
  5. Replace or repair malfunctioning luminaires and components, then retest. Repeat procedure until all units operate properly.
  6. Report results of tests.
- C. Adjusting and Cleaning:
1. Clean luminaires of handling marks, dust and dirt.
  2. Cleaning and touch-up work shall be performed in accordance with luminaire manufacturer's recommendations.
  3. Damaged luminaires or components shall be replaced with new.
  4. Keep luminaires clean and protected for remainder of construction period.
  5. Verify orientation of directional luminaires prior to installation.
    - a. This includes wall washers, cove lighting, floodlights, exterior area lights and adjustable accent luminaires. Contractor shall provide electrician's services to aim, adjust, and focus luminaires, as required, at direction of Architect/Engineer. These electricians shall be available at times designated by Architect/Engineer and shall be provided at no extra charge to Owner over base bid. Contractor shall provide equipment for luminaries' focus including ladders and mechanical lifting systems.
  6. Program preset dimming system lighting levels.
  7. Program ambient light sensors integral to luminaires for appropriate illumination levels as indicated in control narrative or in lighting control specifications.
  8. Program occupancy sensors integral luminaires for appropriate time delay as indicated in control narrative or in lighting control specifications.
  9. Exterior poles, bollards, bases and other exterior luminaires shall be painted to match factory color where finish has been damaged.
  10. No light leaks shall be permitted at ceiling line from any visible part or joint.
- D. Training
1. Contractor shall provide Owner with 3 complete copies of Operations and Maintenance manuals.
    - a. All "Approved as Noted" comments shall be corrected/picked-up in this record manual set.
    - b. Each manual shall contain specific information pertaining to the equipment installed. Each manual shall contain at a minimum:
      - 1). Detailed as built shop drawings for all lighting equipment installed.
      - 2). Manufacturer's product cut sheets for all equipment installed keyed by type as to as built drawings.
        - a). Luminaires
        - b). Control gear/ballasts/drivers
        - c). Lamps
      - 3). Manufacturer's complete installation instructions for all equipment installed keyed by type to as built drawings.
        - a). Luminaires
        - b). Control gear/ballasts/drivers
        - c). Lamps

- 4). Equipment maintenance requirements and schedules.
  - a). Luminaires
  - b). Control gear/ballasts/drivers
  - c). Lamps/LEDs
- 5). Equipment manufacturer contacts.
  - a). Luminaires
  - b). Control gear/ballasts/drivers
  - c). Lamps/LED modules
- 6). Equipment manufacturer warranties.
  - a). Luminaires
  - b). Control gear/ballasts/drivers
  - c). Lamps/LED modules
2. Contractor shall provide qualified personnel onsite to provide a minimum of three days of training to Owner's representatives.
3. This training shall cover:
  - a. Luminaire use and maintenance

END OF SECTION



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## SECTION 27 00 00 - GENERAL COMMUNICATIONS REQUIREMENTS

### PART 1 GENERAL

#### 1.01 SCOPE

- A. This section details references, standards, guidelines, requirements and conditions common to all Division 27 work.
- B. Work under this Section and related sections is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

#### 1.02 DESCRIPTION

- A. Intent of drawings and specifications is to obtain complete systems tested, adjusted, and ready for operation.
- B. Except as otherwise defined in greater detail, terms "provide", "furnish" and "install" as used in Division 27 contract documents shall have the following meanings:
  - 1. "Provide" or "provided" shall mean "furnish and install".
  - 2. "Furnish" or "furnished" does not include installation.
  - 3. "Install" or "installed" does not include furnishing.
- C. Include incidental details not usually shown or specified, but necessary for proper installation and operation.
- D. Check, verify and coordinate work with drawings and specifications prepared for other trades. Include modifications, relocations or adjustments necessary to complete work or to avoid interference with other trades.
- E. Included in this contract are connections to equipment provided by others. Refer to Architectural, Electrical, Integrated Automation, Mechanical, Security and final shop drawings for equipment being furnished under other sections for exact locations of outlets and various connections required.
- F. Information given herein and on drawings is as exact as could be secured but is not guaranteed. Do not scale drawings for exact dimensions.
- G. Where architectural features govern location of work, refer to architectural drawings.
- H. Perform work in "neat and workmanlike" manner as defined in ANSI/NECA 1 "Standard Practices for Good Workmanship in Electrical Contracting".

#### 1.03 RELATED WORK

- A. Related Division 27 Sections include:
  - 1. Section 27 0526 - Grounding and Bonding for Communications Systems
  - 2. Section 27 0528.29 - Hangers and Supports for Communications Systems
  - 3. Section 27 0553 - Communications Systems Identification
  - 4. Section 27 1000 - Structured Cabling
  - 5. Section 27 1100 - Communications Equipment Room Fittings
  - 6. Section 27 1500 - Communications Horizontal Cabling

- B. Related sections in other Divisions of Work:
  - 1. Section 26 0593 – Electrical Systems Firestopping
  - 2. Also refer to individual technical sections identified above.
- C. Temporary Services:
  - 1. Refer to Division 01 - Temporary Facilities and Controls.
- D. Continuity of Service:
  - 1. No service shall be interrupted or changed without permission from Architect and Owner. Obtain written permission before work is started.
  - 2. When interruption of services is required, persons concerned shall be notified and shall agree upon a time.
- E. Demolition:
  - 1. Division 01 - Selective Demolition.
    - a. Not applicable to this Division of work.
  - 2. Division 02 - Building Demolition
    - a. Not applicable to this Division of work.
  - 3. Perform demolition as required to accomplish new work.
    - a. Remove abandoned wiring to source of supply.
    - b. Disconnect abandoned outlets and remove devices.
    - c. Remove abandoned outlets if conduit servicing them is abandoned and removed.
    - d. Provide blank cover for abandoned outlets that are not removed.
    - e. Disconnect communications systems in walls, floors, and ceilings scheduled for removal.
  - 4. Accomplish work in neat workmanlike manner to minimize interference; annoyance or inconvenience such work might impose on Owner or other contractors.
  - 5. Unless otherwise noted, remove from premises materials and equipment removed in demolition work.
  - 6. Equipment noted to be removed and turned over to Owner shall be delivered to Owner at place and time Owner designates.
  - 7. Where materials are to be turned over to Owner or reused and installed by Contractor, it shall be Contractor's responsibility to maintain condition of materials and equipment equal to that existing before work began. Repair or replace damaged materials or equipment at no additional cost to Owner.
  - 8. Where demolition work interferes with Owner's use of premises, schedule work through Architect, Owner and with other contractors to minimize inconvenience to Owner. Architect must approve schedule before Contractor begins such work.
- F. Cleaning and Repair
  - 1. Clean and repair existing materials and equipment that remain or will be reused.
- G. Concrete Work:
  - 1. Provide cast-in-place concrete as required by contract documents unless otherwise noted.
  - 2. Concrete shall comply with Division 03 - Concrete.
  - 3. Provide anchor bolts, metal shapes and templates required to be cast in concrete or used to form concrete for support of equipment.
- H. Painting:

1. Furnish equipment with factory applied prime finish unless otherwise specified.
2. If factory finish on equipment furnished by Contractor is damaged in shipment or during construction, refinish equipment to satisfaction of Engineer.
3. Furnish one can of touch up paint for each factory finish, which will be final finished surface of product.
4. Contractor is responsible for painting of plywood in Telecommunications Equipment Rooms. Refer to Drawings.

#### 1.04 REQUIREMENTS OF REGULATORY AGENCIES

- A. Rules and regulations of Federal, State and local authorities and utility companies, in force at time of execution of contract shall become part of this specification.

#### 1.05 REFERENCES AND STANDARDS

- A. Design, cable and component selection, and installation practices shall conform with following:
  1. ANSI/NFPA 70 - National Electrical Code
  2. Local Electrical Code
  3. Country, state and local health, safety and building codes
  4. UL 444 - Communications Cables
  5. Standards identified in individual Technical Sections.
  6. BICSI Telecommunications Distribution Methods Manual (TDMM)
  7. TIA 568.0-D through.4-D - Commercial Building Telecommunications Cabling Standard (including applicable Addenda)
  8. TIA 569-E - Commercial Building Standard for Telecommunications Pathways and Spaces
  9. STS-1000 – North Carolina SCO Telecommunications Wiring Guidelines
- B. Agencies or publications referenced herein refer to the following:
  1. ANSI American National Standards Institute
  2. ASME American Society of Mechanical Engineers
  3. ASTM American Society for Testing and Materials
  4. BICSI Building Industry Consulting Services International
  5. FIPS Federal Information Processing Standards
  6. FCC Federal Communications Commission
  7. ICEA Insulated Cable Engineers Association
  8. IEEE Institute of Electrical and Electronics Engineers
  9. NEC National Electrical Code
  10. NECA National Electrical Contractors Association
  11. NEMA National Electrical Manufacturers Association
  12. NESC National Electrical Safety Code
  13. NETA National Electrical Testing Association
  14. NFPA National Fire Protection Association
  15. NIST National Institute of Standards and Technology
  16. OSHA Occupational Safety and Health Administration
  17. TIA Telecommunications Industry Association
  18. UL Underwriters Laboratories, Inc.

- C. Work shall be in accordance with latest edition of codes, standards or specifications unless noted otherwise.

#### 1.06 DEFINITIONS

- A. The following definitions are applicable to communications environments and shall apply to this document and its companion sections for clarification and direction.
  - 1. Entrance facility - an entrance to building for both public and private network service cables and/or wireless services including entrance point of building and continuing to Entrance Room.
  - 2. Entrance Room - room where both public and private network service cables and/or wireless services are terminated. Service provider(s) point-of-demarkation (DEMARC) is typically located here.
  - 3. Equipment Room (Telecom): an environmentally controlled centralized space for telecommunications equipment that usually houses main or intermediate cross-connect. Backbone cabling, cabling to Building Entrance and horizontal cabling may be terminated here.
  - 4. Guarantee - promise or an assurance that attests to quality or durability of product or service or that task will be performed in specified manner. Used interchangeably with "Warranty" in these documents.
  - 5. Intra-building - within single building.
  - 6. Inter-building - between 2 or more buildings.
  - 7. IP Telephony – Use of Internet Protocol (IP) for two-way transmission of conversations. Sometimes referred to as "Voice over Internet Protocol (VoIP)".
  - 8. Rack Unit - standard measurement of vertical mounting space on an equipment rack. Each Rack Unit is 1-3/4" high.
  - 9. Voice over Internet Protocol – Refer to IP Telephony.
- B. Typical NEMA Enclosures and Usage
  - 1. Refer to Section 26 0000 – General Electrical Requirements.

#### 1.07 ABBREVIATIONS AND ACRONYMS

- A. The following abbreviations and acronyms shall apply to this document and its companion sections for clarification and direction.
  - 1. AFF Above Finished Floor
  - 2. ATM Asynchronous Transfer Mode
  - 3. AWG American Wire Gauge
  - 4. BAS Building Automation Systems
  - 5. BTU British Thermal Unit
  - 6. CATV Community Antenna Television
  - 7. CCTV Closed-Circuit Television
  - 8. CDDI Copper Distributed Data Interface (Cisco Systems trade name for TP-PMD)
  - 9. cm centimeters
  - 10. °C degrees Celsius
  - 11. °F degrees Fahrenheit
  - 12. DTMF Dual Tone Multi Frequency
  - 13. EIA Electronic Industries Alliance
  - 14. EF Entrance Facility

15. ER	Entrance Room
16. EIDF	Equipment Intermediate Distribution Facility
17. FDDI	Fiber Distributed Data Interface
18. ft	feet
19. GbE	Gigabit Ethernet
20. Hz	Frequency in Hertz (k = kilo, M = Mega, G = Giga)
21. ID	Inside Diameter
22. in	inch
23. IPT	IP Telephony
24. kg	kilogram
25. lbs	pounds
26. LAN	Local Area Network
27. MATV	Master Antenna Television
28. MC	Main Cross-connect
29. m	meters
30. mm	millimeters
31. Mbps	Megabits per second
32. $\mu\text{m}$	micrometer ( $10^{-6}$ meter)
33. OD	Outside Diameter
34. PBX	Private Branch Exchange (Telephone Switch)
35. pF	pico-Farad ( $10^{-12}$ Farad)
36. PVC	Polyvinyl Chloride
37. RU	Rack Unit
38. sq ft	square feet (area)
39. TP-PMD	Twisted Pair Physical Medium Dependent
40. WAN	Wide Area Network
41. WLAN	Wireless Local Area Network
42. VoIP	Voice over Internet Protocol

B. Refer also to technical sections for additional terminology.

#### 1.08 LISTING

A. Refer to technical sections of this Division of work for listing requirements.

#### 1.09 SUBMITTALS

A. Submit shop drawings for equipment provided under this Section:

1. Refer to Division 01 - Submittal Procedures.
2. Note that for satisfying submittal requirements for Division 27, "Product Data" is usually more appropriate than true "Shop Drawings" as defined in Division 01. However, expression "Shop Drawings" is generally used throughout specification.
3. Mark catalog sheets and drawings to indicate specific items submitted.
  - a. Markings shall be reproducible (e.g. arrow, boxed, encircled, checkmark).
  - b. Where sheet includes multiple product options, mark proposed option(s).
4. Include proper identification of equipment by name and/or number, as indicated in specification and shown on drawings.

5. When manufacturer's reference numbers are different from those specified, provide correct cross-reference number for each item. Mark and annotate submittals accordingly.
  6. Group submittals by Section to include complete documentation of related systems, products and accessories. Where applicable, dimensions shall be marked in units to match those specified.
  7. Submittals shall be in electronic form or on paper per Division 01.
    - a. Documents in electronic form shall be *ADOBE Acrobat* PDF.
    - b. Paper documents shall be original catalog sheets or photocopies thereof.
    - c. Facsimile (fax) sheets will not be accepted.
  8. Engineer's Review is to confirm compliance with performance, interoperability, physical, and other pertinent requirements of project. Review is not to confirm quantities nor that all required items have been submitted.
  9. When equipment and items specified include accessories, parts and additional items under one designation, submittals shall be complete and include required components.
  10. Include wiring diagrams for electrically powered or controlled equipment.
  11. Submit equipment room layouts drawn to scale, including equipment, raceways, accessories and clearance for maintenance.
  12. Where submittals cover products containing potentially hazardous non-metallic materials, include "Material Safety Data Sheet" (MSDS) from manufacturer stating physical and chemical properties of components and precautionary considerations required.
  13. Submit shop drawings or product data as soon as practicable after signing contracts. Submittals must be approved before installation of materials and equipment.
  14. Submittals, which are not complete, not permanent, or not properly checked by Contractor, will be returned without review.
  15. "Coordination Drawings", which are normally prepared by Contractor to coordinate work among various trades and to facilitate installation, shall not be submitted for Division 27 work unless specifically requested in technical sections. These types of drawings typically include dimensioned piping, ductwork, communications and/or electrical raceway layouts.
    - a. Unless specifically requested in Division 27 technical sections, submittals of coordination drawings will be returned without review.
- B. Operation and Maintenance Manuals:
1. Refer to Division 01 - Operation and Maintenance Data.
  2. Upon completion of work but before final acceptance of system, submit to Architect for approval, 3 copies of operation and maintenance manuals in loose-leaf binders. If "one copy" is larger than 2" thick or consists of multiple volumes, submit only one set initially for review. After securing approval, submit 3 copies to Owner.
  3. Manuals shall be organized by specification section number and shall have table of contents and tabs for each piece of equipment or system.
  4. Manuals shall include the following:
    - a. Copies of shop drawings
    - b. Manufacturer's operating and maintenance instructions. Include parts lists of items or equipment. Where manufacturer's data includes several types or models, applicable type or model shall be designated.
    - c. CD ROM's of O&M data with exploded parts lists where available
    - d. Phone numbers and addresses of local parts suppliers and service companies
    - e. Internet/WEB page addresses where applicable
    - f. Wiring diagrams

- g. Start up and shut down procedure
  - h. Factory and field test records
  - i. Additional information, diagrams or explanations as designated under respective equipment or systems specification section
5. Instruct Owner's representative in operation and maintenance of equipment. Instruction shall include complete operating cycle on all apparatus.
  6. O&M manuals and instructions to Owner shall be provided prior to request for final payment.
- C. Record Documents:
1. Refer to General Conditions of Contract, and Division 01 - Closeout Procedures. Prepare complete set of record drawings in accordance with Division 01.
  2. Use designated set of prints of contract documents as prepared by Architect to mark-up for record drawing purposes.

#### 1.10 JOB CONDITIONS

- A. Building Access:
1. Arrange for necessary openings in building to allow for admittance of all apparatus.
- B. Cutting and Patching:
1. Refer to General Conditions of Contract, and Division 01 - Cutting and Patching.
  2. Perform cutting and patching required for complete installation of systems unless otherwise noted. Patch and restore work cut or damaged to original condition. This includes openings remaining from removal or relocation of existing system components.
  3. Provide materials required for patching unless otherwise noted.
  4. Do not pierce beams or columns without permission of Architect and then only as directed. If openings are required through walls or floors where no sleeve has been provided, hole shall be core drilled to avoid unnecessary damage and structural weakening.
  5. Where alterations disturb lawns, paving, walks, etc., replace, repair or refinish surfaces to condition existing prior to commencement of work. This may include areas beyond construction limits.
- C. Housekeeping and Cleanup:
1. Refer to Division 01 - Closeout Procedures.
  2. Periodically as work progresses and/or as directed by Architect, remove waste materials from building and leave area of work broom clean. Upon completion of work, remove tools, scaffolding, broken and waste materials, etc. from site.

#### 1.11 WORK BY OWNER

- A. Owner will provide:
1. Active electronics for interface with building voice and data cabling systems
  2. Connections from telephone and data equipment to Contractor provided cabling
  3. Connections from Backbone Voice Cables to Horizontal Voice Cables
  4. Passive Broadband distribution hardware (coaxial cable taps and splitters)
  5. Active Broadband headend and distribution hardware (e.g. video processing, distribution amplifiers)



### 1.12 QUALITY ASSURANCE

- A. Refer to the individual technical sections for general product quality requirements, manufacturer qualifications, and contractor qualifications and certification requirements.

### 1.13 GUARANTEE

- A. Refer to Division 01 for general Guarantee (Warranty) requirements.
- B. Refer to technical sections for Guarantee requirement for each system.
  - 1. Where no guarantee requirements are called out, guarantee as called out in Division 01 equipment, materials, and workmanship to be free from defect.
- C. Repair, replace or alter systems or parts of systems found defective at no extra cost to Owner.
- D. Wherein fulfilling requirements of any guarantee, if Contractor disturbs any work guaranteed under another contract, restore such disturbed work to condition satisfactory to Architect and guarantee such restored work to same extent as it was guaranteed under such other contract.
- E. Guarantees shall include labor, material and travel time.

## PART 2 PRODUCTS

### 2.01 PRODUCT SUBSTITUTIONS

- A. Refer to Division 01 - Product Requirements.

## PART 3 EXECUTION

### 3.01 GENERAL

- A. Verify elevations and measurements prior to installation of materials.

### 3.02 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Division 01.
- B. Store and protect products under provisions of Division 01.
- C. Store in clean, dry space.
- D. Maintain factory wrapping or provide cover to protect units from dirt, water, construction debris, and traffic.
- E. Handle in accordance with manufacturer's written instructions.
- F. Handle carefully to avoid damage to components, enclosure, and finish. Lift only with lugs provided for the purpose.

### 3.03 FLOOR, WALL, ROOF AND CEILING OPENINGS

- A. Coordinate location of openings, chases, furred spaces, etc. with appropriate Contractors. Provide during progress of construction sleeves and inserts that are to be built into structure.

- B. Temporary sleeves, if used to form wall openings, shall be removed prior to installation of permanent materials. Permanent sleeves for wall penetrations shall be minimum 24 ga galvanized sheet metal unless otherwise noted.
- C. Steel sleeves, when required, shall be Schedule 40 carbon steel pipe with integral water stop.
- D. For core drilled holes, size and location shall be reviewed and approved by Structural Engineer prior to execution.
- E. Submit product data and installation details for penetrations of building structure. Submittal shall include schedule indicating penetrating materials, (including steel conduit, PVC conduit, cables, cable tray), sizes of each, opening sizes and sealant products intended for use.
- F. Where penetrations of fire-rated assemblies are involved, seal penetrations with appropriate firestopping systems as specified in Division 26.
- G. Submit complete penetration layout drawings showing openings in building structural members including floor slabs, bearing walls, shear walls. Indicate and locate, by dimension, required openings including those sleeved, formed or core drilled. Drawings shall be approved by the structural engineer prior to preparing openings in structural member.
- H. Openings for penetrations shall be minimum 1/2" larger on all sides than outside dimensions of raceways or cables. However, where fire resistant penetrations are required, size openings in accordance with recommendations of firestopping systems manufacturer.
- I. Seal non fire-rated floor penetrations with non-shrink grout equal to Embeco by Master Builders, or urethane caulk, as appropriate.
- J. Seal non-rated wall openings with urethane caulk.
- K. Where penetrations occur through exterior walls into building spaces, use steel sleeves with integral water stop, similar to type "WS" wall sleeves by Thunderline Corporation. Seal annular space between sleeves and pipe with "Link-Seal" modular wall and casing seals by Thunderline Corporation, or sealing system by another manufacturer approved as equal by Architect. Sealing system shall utilize Type 316 stainless steel bolts, washers and nuts.
- L. Finish and trim penetrations as shown on details and as specified hereinafter.
- M. Provide chrome or nickel plated escutcheons where raceways pass through walls, floors or ceilings and are exposed in finished areas. Size escutcheons to fit raceways for finished appearance. Finished areas shall not include mechanical/electrical rooms, janitor's closets, storage rooms, etc., unless suspended ceilings are specified.

### 3.04 EQUIPMENT ACCESS

- A. Install raceways, junction and pull boxes, and accessories to permit access to equipment for maintenance. Relocation of raceways, or accessories as required to provide access, shall be provided at no additional cost to Owner.
- B. Install equipment with ample space allowed for removal, repair or changes to equipment. Provide ready accessibility to equipment and wiring without moving other equipment, which is to be installed or which is already in place.
- C. Access doors in walls, chases, or inaccessible ceilings will be provided under Division 08 - Access Doors and Frames, unless otherwise indicated. Access doors shall be for purpose of

providing access where equipment requiring servicing, repairs or maintenance is located in walls, chases or above inaccessible ceilings.

- D. Provide necessary coordination and information to Trade Contractor under Division 08 - Access Doors and Frames. This information shall include required locations, sizes and rough-in dimensions, without limitations.
- E. Provide access doors where equipment, requiring access for servicing, repairs and maintenance is located in walls, chases or above inaccessible ceilings, unless otherwise noted. Access frames and doors shall be as manufactured by Milcor, Incorporated, or similar, of style applicable to surface. Access doors used in fire-rated construction shall have UL label. Access doors shall be steel, prime coated, except use stainless steel doors in ceramic tile walls, toilet rooms, locker rooms, and in areas subject to excessive moisture. Access doors shall be of sufficient size to allow for total maintenance. Location of access doors shall be coordinated with General Contractor and location of equipment shall be roughed in accordingly.
- F. Locate communications outlets and equipment to fit details, panels, decorating or finish at space. Architect reserves right to make minor position changes of outlet locations before work has been installed.
- G. Verify room door swings before installing wall-mounted communications outlets and install boxes on latch side of door unless otherwise noted.

### 3.05 EQUIPMENT SUPPORTS

- A. Provide supporting steel not indicated on drawings as required for installation of equipment and materials including angles, channels, beams, hangers.
- B. Concrete anchors, used for attachment to concrete, shall be steel shell with plug type. Plastic, rawhide or anchors utilizing lead are not allowed.
- C. Do not support equipment or cable pathways from metal roof decking.

### 3.06 SUPPORT PROTECTION

- A. In occupied areas, mechanical rooms and areas requiring normal maintenance access, certain equipment must be guarded to protect personnel from injury.
- B. Provide minimum 1/2" thick Armstrong Armaflex insulation or similar product applied with Armstrong 520 adhesive on lower edges of equipment, including bus duct, cable tray, pull boxes and electrical supporting devices suspended less than 7 ft above floors, platforms or catwalks in these areas.
- C. Threaded rod or bolts shall not extend beyond supporting element and shall be protected as described above.

### 3.07 CABLE PROTECTION

- A. Protect cabling and termination components from contact with, and potential application of, foreign materials.
  - 1. Foreign material is defined as material that is not part of cabling assembly and termination components when delivered from manufacturer.
  - 2. Examples include paint overspray and drywall compound.
- B. Cabling and components that come into contact with foreign materials shall be replaced at no cost to project.

1. Solvents and other cleaning agents shall not be used to remove foreign materials that have already accumulated on cabling and components.

### 3.08 HOUSEKEEPING PADS

- A. Not applicable to this Division of work.

### 3.09 LEAD SHIELDING

- A. Wherever installation of this Contractor's equipment destroys radiological integrity of wall, floor, or ceiling, this Contractor shall be responsible to provide suitable lead shielding to maintain that integrity. Coordinate these requirements with General Contractor.

### 3.10 ACCEPTANCE TESTING

- A. Prior to testing, submit to owner (or Owner's representative) and Engineer, proposed schedule for acceptance testing.
  1. This notification shall be minimum of 10 working days in advance to allow for participation by Owner and/or Engineer.
- B. Prior to testing, submit written description of intended test procedures and submit sample test forms to Engineer.
  1. Submitted information shall include proposed file naming format to be used in identifying cable, pair or optical fiber which is subject of test record.
  2. Failure to provide above information shall be grounds for Engineer or Owner to reject any Documentation of related testing and to require repeat of affected test.
- C. Conduct tests during course of construction when identifiable portion(s) of installation is complete.
  1. Alternatively, testing can be conducted after entire installation is complete if this does not delay project schedule.
- D. Provide equipment and personnel necessary to conduct acceptance tests.
- E. Testing shall be completed and accepted by Owner and Engineer before Owner furnished equipment and cross connects are installed.
- F. Document tests.
- G. When equipment or systems fail to meet minimum test requirements, replace or repair defective work or materials as necessary and repeat inspection and test. This shall be at no additional cost to the owner. Replacement materials shall be new.
- H. This Contractor is responsible for certifying, in writing, equipment and system test results. Certification shall include identification of portion of system tested, date, time, test criteria and name and title of person signing test certification documents.
- I. Maintain copies of certified test results, including those for failed tests, at project site. At completion of project, include copies of test records and certifications in O&M Manuals.

### 3.11 START-UP

- A. Systems and equipment shall be started, tested, adjusted and turned over to Owner ready for operation.

1. This includes "Owner-Furnished, Contractor-Installed" (OFICI) and "Contractor-Furnished, Contractor-Installed" (CFICI) systems and equipment.
- B. Follow manufacturer's pre-start-up checkout, start-up, trouble shooting and adjustment procedures.
- C. Contractor shall provide services of technician/installer knowledgeable in start-up and checkout of types of systems and equipment on project.
- D. Provide start-up services, by manufacturer's representative where specified or where Contractor does not have qualified personnel.
- E. Coordinate start-up with trades.

### 3.12 DOCUMENTATION

- A. Upon completion of installation, Contractor shall provide System Documentation. Documentation shall include:
  1. Acceptance Test Results
  2. Record Drawings
  3. All Approved Submittals
  4. Manufacturer's Warranty Documents
- B. Submit System Documentation in accordance with Division 01 "Project Record Documents".
  1. Documents shall be submitted in same electronic format in which they were received from Architect and Engineer.
  2. Document updates shall be performed in native software format matching original design team documents.
    - a. Scans of hand marked documents shall not be allowed.
  3. Update documents to reflect installed conditions for equipment shown on documents.
- C. Submit documentation within ten (10) working days of the completion of testing of each testing phase (e.g. subsystem, cable type, area, floor) or 3 weeks prior to scheduled occupancy of subject area, whichever is sooner. This is inclusive of Test Result and draft Record Drawings.
  1. Draft drawings may include mark-ups done by hand.
  2. Machine generated (final) copies of Record Drawings shall be submitted within 30 working days of completion of each testing phase.
  3. Documentation will include all aspects of systems covered by these specifications that are required for systems to be fully functional.
  4. For structured cabling this includes the horizontal link from the TO to the HC, backbone cabling from the HC to the MC, cross-connections, interconnections and/or patch cords that are the responsibility of the contractor.
- D. Submit Acceptance Test Results in electronic form for review and distribution.
  1. Interim documentation of Test Results (if applicable) may be submitted via email or on CD-ROM.
  2. Final documentation of Test Results shall be submitted on CD-ROM.
  3. Test results shall be submitted in format(s) native to test instrument(s) used in performing testing.
  4. Where unique software (other than an MS-Word™ compatible Word Processor or MS-Excel™ spreadsheet) is required for viewing of test results, Contractor shall provide along with above

documentation, (1) licensed copy of such software. Software shall run on MICROSOFT Windows-based personal computer.

- E. Acceptance Test results shall include description of sub-system tested, equipment/cable/outlet I.D., reference and test setup, test equipment type/model and serial number(s), equipment location and direction of test (if applicable), test frequencies/wavelengths, date and operator name(s).
- F. Engineer or Owner may request that 10% random re-test be conducted on cable system - at no additional cost - to verify documented findings. Tests shall be a repeat of those defined above and in technical sections.
  - 1. Owner may also perform independent testing to verify results.
  - 2. If findings contradict documentation submitted by Contractor, additional testing can be requested to extent determined necessary by Engineer or Owner, including 100% re-test. This re-test shall be at no additional cost to Owner.
- G. Documentation - including hard copy and electronic forms of Test Data and Record Drawings - shall become property of Owner.
- H. Refer also to Technical Sections for requirements specific to covered subsystems.

### 3.13 CLEANING

- A. After installation is complete, Contractor shall clean all systems.
- B. Vacuum debris from system components, enclosures, junction boxes and pull boxes prior to testing and again prior to completion.
- C. Thoroughly clean equipment of stains, paint spots, dirt and dust. Remove temporary labels not used for instruction or operation.

END OF SECTION

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## SECTION 27 05 28.29 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

### PART 1 GENERAL

#### 1.01 SCOPE

- A. This section includes product and execution requirements for items unique to communications systems and not included in Division 26 sections.
- B. Refer to Section 27 0000 – General Communications Requirements and 26 0529 - Hangers and Supports for Electrical Systems - Part 1 for requirements for Reference Standards, Submittals, Quality Assurance, Delivery/Storage/Handling, and Guarantee.

#### 1.02 RELATED WORK

- A. Related Division 27 Sections include:
  - 1. Section 27 0000 - General Communications Requirements
  - 2. Section 27 1000 - Structured Cabling
  - 3. Section 27 1100 - Communications Equipment Room Fittings
  - 4. Section 27 1500 - Communications Horizontal Cabling
- B. Related sections in other Divisions of Work:
  - 1. Section 26 0529 - Hangers and Supports for Electrical Systems

#### 1.03 REFERENCES AND STANDARDS

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

### PART 2 PRODUCTS

#### 2.01 PRODUCTS COMMON WITH ELECTRICAL SYSTEMS

- A. Refer to Section 26 0529 - Hangers and Supports for Electrical Systems - Part 3 for:
  - 1. Hanger Rods
  - 2. Beam Clamps
  - 3. Wall Anchors
  - 4. Metal Framing

#### 2.02 J-TYPE CABLE SUPPORT HOOKS

- A. Cable support hooks shall be a wide-base type for use in a non-continuous pathway.
- B. Hook material shall be Galvanized metal or Nylon for smooth cable pull and corrosion resistance.
  - 1. Hook may be coated to reduce cable friction.
  - 2. Hook material shall be rigid. Flexible material not allowed.
- C. Hooks shall:
  - 1. Comply with UL, cUL, NEC and TIA requirements for structured cabling systems.
  - 2. Be designed to limit cable bending per cable manufacturers' recommendations.
  - 3. Be capable of being installed in a single- or multiple-hook ("tree") configuration.



4. Incorporate a latch or other mechanism to retain cable.

### PART 3 EXECUTION

#### 3.01 PRODUCTS COMMON WITH ELECTRICAL SYSTEMS

- A. Refer to Section 26 0529 - Hangers and Supports for Electrical Systems - Part 3 for all products identified in Part 1.

#### 3.02 J-TYPE CABLE SUPPORT HOOKS

- A. Where installed free-air above suspended ceiling or below raised floor, support cables using J-hook type cable supports installed in accordance with manufacturer's installation requirements.
- B. Support hooks from structure. Do not support from ceiling grid, conduit or other trades work.
- C. Space J-hook cable supports every 4 ft or in accordance with cable manufacturer's specifications, whichever distance is shorter.
- D. J-hook fill capacities shall be per manufacturer's recommendations and shall consider diameter of cable type(s) being installed.

END OF SECTION

## SECTION 27 05 53 - COMMUNICATIONS SYSTEMS IDENTIFICATION

### PART 1 GENERAL

#### 1.01 SCOPE

- A. This section details product and execution requirements for labeling of communications cabling, termination components, pathways and spaces for Communications Systems.

#### 1.02 DESCRIPTION

- A. All components shall be clearly labeled to identify them as unique throughout the project.
- B. Labeling requirements include identification of Rooms, Equipment Racks, Telecommunications Outlets, Horizontal and Backbone Cabling, Termination Hardware (Patch Panels, Blocks) and Grounding.

#### 1.03 RELATED WORK

- A. Related Division 27 Sections include:
  - 1. Section 27 0000 - General Communications Requirements
  - 2. Section 27 1000 - Structured Cabling
  - 3. Section 27 1100 - Communications Equipment Room Fittings
  - 4. Section 27 1500 - Communications Horizontal Cabling
- B. Related sections in other Divisions of Work:
  - 1. Refer to individual technical sections identified above (if applicable).

#### 1.04 REFERENCES AND STANDARDS

- A. Refer to Section 27 0000 - General Communications Requirements which identifies pertinent References and Standards.
- B. Other applicable references and standards include:
  - 1. TIA-606-C - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

#### 1.05 DEFINITIONS

- A. Refer to Section 27 0000 - General Communications Requirements and Section 27 1000 - Structured Cabling which provide information on Definitions used in this and related sections.

#### 1.06 ABBREVIATIONS AND ACRONYMS

- A. Refer to Section 27 0000 - General Communications Requirements and Section 27 1000 - Structured Cabling which provide information on Abbreviations and Acronyms used in this and related sections.

#### 1.07 WORK BY OWNER

- A. Refer to Section 27 0000 - General Communications Requirements which identifies Work by Owner affecting sub-system(s) covered by this section.

## 1.08 SUBMITTALS

- A. Refer to Section 27 0000 - General Communications Requirements and Section 27 1000 - Structured Cabling which provide general guidelines for product and/or installation information to be submitted by contractor.
- B. Prior to installation, provide samples of label types planned for the project.
  - 1. Samples shall include examples of lettering to be used and shall follow standards detailed below.

## 1.09 QUALITY ASSURANCE

- A. Refer to Section 27 0000 - General Communications Requirements which identifies general quality assurance requirements for the project.

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. Labels and markings shall be physically and chemically resistant to damage that would make label unreadable.
- B. Cable labels shall be self-laminating, White/Transparent Vinyl (or other substrates facilitating easy application and flex as cables are bent) and incorporate an integrated clear lamination which covers printed part of label when label is wrapped around cable.
  - 1. If cable jacket is white, provide cable label with printing area that is a color other than white to easily distinguish label from cable jacket.
  - 2. Labels shall be of adequate size to accommodate circumference of cable(s) being marked and properly self-laminate over full extent of printed area of label.
  - 3. Labels on larger cables (e.g. Copper Backbone) may be wrapped with clear non-removable tape.
- C. Labels shall use aggressive adhesives that stay attached even to the most difficult to adhere to jacketing. Tags shall be non-removable.
  - 1. Exceptions:
    - a. Telecommunications Outlet labels that are placed in recessed label holders.
    - b. Telecommunications Ground tags secured with cable ties.
    - c. Innerduct Tags secured with cable ties.
- D. Labels for 110-type Termination Blocks shall be Color-coded to indicate the cable type (inter-building, intra-building backbone, horizontal, etc.). Refer to Part 3.

## PART 3 EXECUTION

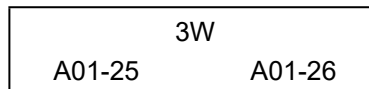
### 3.01 GENERAL

- A. Labeling shall be by mechanical means.
  - 1. Hand lettered designations are not allowed.
- B. Tags shall be non-removable.
  - 1. Exceptions:
    - a. Telecommunications Outlet labels that are placed in recessed label holders.

- b. Telecommunications Ground tags secured with cable ties.
- c. Innerduct Tags secured with cable ties.
- C. Characters shall be Black Ink and printed on background of contrasting color.
- D. Labels shall match hardware layout and design.
- E. Labels shall be as large as practicable while fitting properly.
- F. No lettering shall be smaller than 10-point.
- G. Label cables with tag which is wrapped around cable sheath.
  - 1. Clean cable sheath thoroughly before applying label.
  - 2. Labels shall not be obscured by termination hardware.

### 3.02 TELECOMMUNICATIONS OUTLET

- A. Label each Telecommunications Outlet (TO) connector with unique identifying code.
- B. Telecommunications Outlet connector numbering shall result in logical numbering sequence in work area.
  - 1. Labeling plans that results in random TO numbering in work area are not acceptable.
- C. Place Faceplate labels on outside of cover.
- D. Position Labels in recessed label holders on faceplate and covered with clear plastic covers.
  - 1. Where Communications Outlet Faceplates not incorporating recessed holders are allowed, faceplate labels shall be protected with clear laminate.
- E. Telecommunications Outlet labeling code shall be as follows:
  - 1. TR-RPP-##, where:
    - a. "TR" is identifier for room where cable terminates in horizontal cross-connect.
    - b. "R" is identifier for Equipment Rack where cable terminates
      - 1). Alpha character starting at "A".
    - c. "PP" is Patch Panel on which cable is terminated at HC.
      - 1). Number starting at "01".
      - 2). Panel numbering shall be from Top (of Rack) to Bottom.
    - d. "##" is sequential POSITION of Jack on Panel
      - 1). 1 - 48 is typical
      - 2). Position sequence shall be Left-Right and Top-Bottom.
  - 2. Example: "3W-A03-25" represents 25th Jack Position in 3rd Panel on Equipment Rack "A" in Telecom Room "3W".
    - a. Faceplate labels can use common TR identifiers on each label strip. For example, two data jacks served from TR 3W sharing common label strip may be represented by:



### 3.03 HORIZONTAL CABLING

- A. Label each horizontal cable at Telecommunications Outlet and at horizontal cross-connect with unique identifying code.
- B. Cable shall be labeled at both ends within 4" of cable choke (end of jacket).
- C. Horizontal labeling code shall be same as identified for Telecommunications Outlet above.

### 3.04 MODULAR PATCH PANEL

- A. Label each patch panel and port at horizontal cross-connect with unique identifying code.
- B. Patch panel labeling code shall be same as identified for Telecommunications Outlet above
- C. Room number is not required on modular patch panels.
- D. Equipment Rack number is not required on modular patch panels.

END OF SECTION

## SECTION 27 10 00 - STRUCTURED CABLING

### PART 1 GENERAL

#### 1.01 SCOPE

- A. This section details product and execution requirements for Structured Cabling for Communications Systems.

#### 1.02 DESCRIPTION

- A. Systems shall include cabling, termination hardware and active components, installed as indicated on drawings and specifications.
- B. Cables and equipment shall be provided, tested, and terminated, including proper grounding and bonding.
- C. Work also includes removal and recycling of unused, undocumented and otherwise "abandoned" cables as identified in Part 3 of this Section.

#### 1.03 RELATED WORK

- A. Related Division 27 Sections include:
  - 1. Section 27 0000 - General Communications Requirements
  - 2. Section 27 0528.29 - Hangers and Supports for Communications Systems
  - 3. Section 27 0553 - Communications Systems Identification
  - 4. Section 27 1100 - Communications Equipment Room Fittings
  - 5. Section 27 1500 - Communications Horizontal Cabling
- B. Related sections in other Divisions of Work:
  - 1. Refer to individual technical sections identified above (if applicable).

#### 1.04 REFERENCES AND STANDARDS

- A. Refer to Section 27 0000 - General Communications Requirements which identifies pertinent References and Standards.
- B. In addition:
  - 1. TIA 568.0-D through.4-D - Commercial Building Telecommunications Cabling Standard (including applicable Addenda)
  - 2. TIA 569-E598 - Commercial Building Standard for Telecommunications Pathways and Spaces.
  - 3. BICSI Telecommunications Distribution Methods Manual (TDMM)
  - 4. TIA-598-D: Optical Fiber Cable Color Coding.
  - 5. TIA 455-21-A: Mating Durability for Fiber Optic Interconnecting Devices
  - 6. TIA 526-14-C: Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
  - 7. TIA-526-7-A: Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
  - 8. UL-910: Tests for Flame Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables used in Spaces Transporting Environmental Air

9. UL-1666: Tests for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
10. IEEE 802.3af and 802.3at Power-over-Ethernet Standards.
11. IEEE 802.3an 10 Gigabit Standard

#### 1.05 DEFINITIONS

- A. Refer to Section 27 0000 - General Communications Requirements for general terminology used in Division 27 sections.
- B. In addition, the following definitions are applicable to communications environments and shall apply to this document and its companion sections for clarification and direction:
  1. Backbone Cabling - cable or conductors between telecommunications rooms, or floor distribution terminals, entrance facilities, and equipment rooms within or between buildings. Backbone cabling may be twisted pair copper, fiber optic or coaxial.
  2. Cable - assembly of 1 or more conductors or optical fibers within enveloping sheath, constructed so as to permit use of conductors singly or in groups.
  3. Cable ID - unique alpha-numeric identification used for tagging of backbone or horizontal cabling.
  4. Channel - end-to-end transmission path to which application-specific equipment is connected. Same as "Permanent Link", but also includes patch cords at Telecommunications Outlet and in Telecom Room.
  5. Consolidation Point (CP): A location for interconnection between horizontal cables extending from the horizontal cross-connect and horizontal cables extending to the telecommunication outlet at the workstation.
  6. Contractor: Telecommunications Contractor or sub-contractor(s) responsible for installation, termination, test and documentation of communications cabling, termination components, pathway hardware, telecommunications equipment room hardware and related components detailed in technical sections of this Division of work.
  7. Cross-Connect - group of connection points between cabling runs and/or equipment used to administer building wiring using patch cords or wire jumpers.
  8. Horizontal Cabling - Cables connecting Telecommunications Outlets to horizontal or intermediate cross-connect. Sometimes referred to as "Station Cabling".
  9. Horizontal Cross-connect (HC) – Connection of horizontal cabling to other cabling (e.g. horizontal, backbone or equipment) using patch cords or wire jumpers.
  10. Interconnection - Connection scheme using connecting hardware for the direct connection of a cable to another cable without a patch cord or jumper
  11. Main Cross-connect (MC) – Connection between backbone cables, entrance cables and equipment cables using patch cords or wire jumpers.
  12. Outlet ID - unique alpha-numeric identification used for referencing Telecommunications Outlet or connectors therein.
  13. Permanent (Cable) Link - includes Telecommunications Outlet, horizontal (station) cable and termination hardware in Telecom Room.
  14. Service Loop - Surplus cable, typically located at or near point of termination to enable future changes.
  15. Telecommunications Outlet (TO) - device assembly located in work area on which horizontal cabling terminates and which can receive modular connectors. It is interface between Station Cable and end user's equipment.

16. Telecom Room - an enclosed space for housing telecommunications equipment, horizontal and backbone cable terminations, and cross-connect cabling, that is recognized location of horizontal cross-connect.
  17. Zone Box - An enclosure used to house one or more of the following; a) a consolidation point, b) a horizontal connection point, c) building automation system outlets.
  18. Zone Cabling - Extends permanent horizontal cabling to a shared termination (consolidation) point in the work area. Passive system extends link to workstation through at interconnect at the Consolidation Point (CP). Active system includes system electronics at the CP.
- C. "10-gigabit" or "10G" performance criteria, if applicable, refers to support of 10GBASE-T application over 4-conductor channel up to 100 meters and meeting requirements of TIA-568-C.2.

#### 1.06 ABBREVIATIONS AND ACRONYMS

- A. Refer to Section 27 0000 - General Communications Requirements for general terminology used in Division 27 sections.
- B. In addition, the following abbreviations and acronyms shall apply to this document and its companion sections for clarification and direction:
1. 8P8C Eight-Position, Eight-Conductor. Used in clarifying jack type; a.k.a. "RJ-45".
  2. CM Communications cable rated for General Purpose use
  3. CMP Communications cable rated for use in Plenum areas
  4. CMR Communications cable rated for use in Risers and vertical runs
  5. CP Consolidation Point
  6. ELFEXT Equal-Level Far-End Cross Talk (pair-to-pair)
  7. FEXT Far-End Cross Talk
  8. F/UTP Foiled Unshielded Twisted Pair  
No shielding around individual pairs and an overall foil shield under the cable jacket
  9. HC Horizontal Cross-connect
  10. HCP Horizontal Connection Point (e.g. for TIA-862)
  11. IDF Intermediate Distribution Frame
  12. MC Main Cross-connect
  13. MDF Main Distribution Frame
  14. MPTL Modular Plug Terminated Link
  15. N Newton
  16. NEXT Near End Cross Talk
  17. OFNP Optical Fiber Nonconductive Plenum
  18. OFNR Optical Fiber Nonconductive Riser
  19. OTDR Optical Time Domain Reflectometer
  20. PBX Private Branch Exchange (Telephone Switch)
  21. PoE Power-over-Ethernet
  22. PSNEXT Power Sum Near End Cross Talk
  23. S/FTP Screened Foiled Twisted Pair  
(Individual foil shield around each individual pair and an overall braided shield under the cable jacket.)



- 24. S/UTP Screened Unshielded Twisted Pair  
(No shielding around individual pairs and an overall braided shield under the cable jacket.)
- 25. SF/UTP Screened Foiled Unshielded Twisted Pair  
(No shielding around individual pairs and overall foil and braided shields under the cable jacket.)
- 26. TO Telecommunications Outlet
- 27. TR Telecommunications Room
- 28. USOC Universal Service Order Code
- 29. UTP Unshielded Twisted Pair  
(No shielding around pairs nor overall under cable jacket.)
- 30. U/FTP Unshielded Foiled Twisted Pair  
(Individual foil shield around each individual pair and no overall braided shield under the cable jacket.)

#### 1.07 WORK BY OWNER

- A. Refer to Section 27 0000 - General Communications Requirements which identifies Work by Owner affecting sub-system(s) covered by this section.

#### 1.08 SUBMITTALS

- A. Refer to Section 27 0000 - General Communications Requirements which provides general guidelines for product or installation information to be submitted by Contractor.
- B. In addition, Submit:
  - 1. Contractor Certification documents which document their participation in Installers Program operated by Manufacturer of Cabling or Termination Components used.
    - a. Upon request, Certified Installer(s) assigned to Project shall be identified to Engineer.

#### 1.09 QUALITY ASSURANCE

- A. General:
  - 1. Cable and Equipment Manufacturer(s) shall be company specializing in communications cable, accessories and/or equipment with minimum of 5 years documented experience in producing cable, accessories and/or equipment similar to those specified herein.
- B. Contractor Qualifications:
  - 1. Qualified personnel utilizing state-of-the-art equipment and techniques shall complete cable and equipment installation and termination.
  - 2. Contractor shall have been in this business for minimum of 5 years and shall have successfully completed 4 projects equal in magnitude of system specified in the following sections.
- C. Contractor shall have necessary certifications to provide for Warranty as specified herein.
  - 1. Contractor shall be an active participant in Installers Program operated by Manufacturer of Cabling or Termination Components used.
    - a. Contractor shall be participant in this program at time of Bidding and remain so throughout project.

### 1.10 GUARANTEE

- A. Refer to Division 01, General Conditions, and General Requirements - Guarantee Documents and Section 27 0000 - General Communications Requirements for general guarantee requirements.
- B. Warranty structured cable system as follows:
  - 1. 4-pair Category-rated Horizontal Copper Permanent Link for no-less than 20 years from date of substantial completion of work.
- C. Warranty shall be direct from manufacturer(s) of cabling and connecting components to Owner.

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. Refer to individual Technical Sections.

### 2.02 SYSTEM REQUIREMENTS

- A. Structured cabling products shall be designed to work together as a fully-warranted system.
- B. Acceptable Category 6 systems shall be:
  - 1. Leviton CX6200 Cat 6 Premium UTP System
  - 2. Panduit Enhanced Category 6 System (Panduit cable only)
  - 3. Siemon Premium 6 Z-MAX

## PART 3 EXECUTION

### 3.01 GENERAL

- A. Refer to individual technical specification sections for detailed Cable Routing and Installation, Testing and Documentation requirements. The following apply to communications cabling and termination work.
- B. Installation shall be per manufacturers' recommendations.
- C. Label cables and termination components per Section 27 0553 - Communications Systems Identification.

### 3.02 REMOVAL AND RECYCLING OF ABANDONED CABLE

- A. Remove and recycle unused, undocumented and otherwise "abandoned" cables prior to the completion of the project.
  - 1. Definition of Abandoned Cable is contained in NEC 2002 Articles: 640, 645, 725, 760, 770, 800, 810, 820 and 830. Further definition is contained in NFPA-75, NFPA-76 and NFPA-90A.
- B. Owner shall be available to assist in the identification of these cables.

### 3.03 CABLE INSTALLATION

- A. Run cabling in raceways provided, or as designated on floor plans, and support from building structure.

1. Where installed in free-air, support cables using J-hook type cable supports installed in accordance with manufacturer's installation requirements. Refer to Section 27 0528.29 - Hangers and Supports for Communications Systems for installation requirements.
  - a. J-hook fill capacities shall be per manufacturer's recommendations and shall consider diameter of cable type(s) being installed.
  - b. Route cable/hooks at right angles, parallel to construction.
2. Where installed in Cable Tray, lay cables neatly in tray.
  - a. Do not tie.
  - b. Provide sufficient slack in cables to allow for unequal expansion coefficients of cable tray and cables. This requirement is in addition to slack required at cable tray expansion joints.
- B. Route and support cable in Equipment Rooms and Telecom Rooms utilizing "D-type" mounting rings, J-hooks and overhead cable runway.
- C. Cable shall be free of tension at both ends.
  1. In cases where cable must bear stress, provide Kellems grips to spread stress over longer length of cable.
- D. Provide required installation tools to facilitate cable pulling without damage to cable jacket.
- E. Keep cables clear of other trades work.
- F. During pulling operation provide an adequate number of workers to allow cable observation at points of raceway entry and exit, as well as to feed cable and operate pulling machinery.
- G. Pull cables in accordance with cable manufacturer's recommendations and ANSI/IEEE C2 Standards.
- H. Pull cable by hand unless installation conditions require mechanical assistance.
- I. Do not exceed recommended pulling tensions and bending radii.
  1. Where mechanical assistance is used, ensure that maximum tensile load for cable is not exceeded.
    - a. This may be in form of continuous monitoring of pulling tension, use of "break-away" or other approved method.
  2. Replace cables bent or kinked to radius less than recommended dimension.
    - a. This shall be at no expense to Owner.
- J. Install cables splice-free unless otherwise specified.
- K. Avoid abrasion and other damage to cables during installation.
  1. Visually inspect cables for cuts, blisters and abrasions during installation.
- L. Pulling lubricant may be used and shall:
  1. Be non-injurious to cable jacket and other materials used.
  2. Not harden or become adhesive with age.
- M. Repair damage to interior spaces caused by installation of cable, raceway or other hardware. Repairs must match preexisting color and finish of walls, floors and ceilings.
- N. Replace contractor-damaged ceiling tiles to match color, size, style and texture.

- O. Provide pull cord (200 lb minimum) with cable installed in conduit or innerduct.
- P. Neatly lace, dress and support cabling.
- Q. In vertical pathway, support cables on each floor using industry recognized support methods designed specifically for that purpose.
  - 1. Strap vertical runs as required, to prevent sagging of cables.
- R. To reduce effects of EMI, adhere to the minimum cable separation distance defined in TIA-569-C.

### 3.04 FIELD TESTING

- A. Refer to Section 27 0000 - General Communications Requirements for general guidelines regarding requirements for scheduling and performing compliance testing.
- B. Cabling shall be 100% fault free unless otherwise noted. If any **[Link] [Channel]** is found to be outside specification defined herein, identify and correct problem up to and including replacement of cable and associated termination(s). Then repeat applicable tests.
- C. Test each cabling sub-system (e.g. backbone, horizontal, etc.) end-to-end.
- D. Where sub-systems are to be interconnected or cross-connected by the contractor, test individual sub-system followed by a test of the connected links
  - 1. Performance and documentation requirements shall default to the lesser of the two connected systems if different.
  - 2. Example 1: Combined Backbone-Horizontal Link
    - a. Test and document individual Backbone and Horizontal Cabling Sub-systems.
    - b. Cross-connect sub-systems.
    - c. Repeat testing on combined cabling from MC - TO through HC.
    - d. Performance and documentation requirements shall be based in this example on backbone cabling (continuity, pair integrity, etc.).
  - 3. Example 2: Interconnected Zone Cabling Link
    - a. Test and document individual HC – CP links.
    - b. Install interconnect cabling CP – TO
    - c. Repeat testing on combined cabling from HC – TO through CP.
    - d. Performance and documentation requirements shall be based in this example on TIA Permanent Link for Horizontal Cabling.
- E. Test instrument shall be configured using template for exact cable under test (e.g. by manufacturer product designation).
  - 1. If no template is available, enter cable parameters for the cable per manufacturer's product data.
    - a. Nominal Velocity of Propagation (NVP) used for copper cable type under test shall be traceable to manufacturers' product data.
    - b. Refractive Index used for fiber optic cable type under test shall be traceable to manufacturers' product data.
  - 2. Test results obtained using incorrect cable parameters will be rejected.
- F. Test instrument shall be calibrated as defined by instrument manufacturer at least once every 12 months.

1. Test instrument calibration date shall be present in test results documentation.
- G. Refer to individual Technical Sections for system-specific guidelines regarding requirements for scheduling and performing compliance testing.

### 3.05 DOCUMENTATION

- A. Refer to Section 27 0000 - General Communications Requirements for general guidelines regarding requirements for project Documentation.
- B. Refer to individual Technical Sections for system-specific guidelines regarding requirements for project Documentation.
- C. Information added by Contractor to Record Drawings shall include:
  1. Backbone and horizontal cable routes
  2. Telecommunications outlet locations and identification
  3. Other detail necessary to document cable installation

### 3.06 OWNER TRAINING

- A. Provide training for Owner's personnel on operation and maintenance of total system and each component.
- B. Training to include:
  1. Overview of System Topology and General Concepts
  2. Overview of Product Used
  3. Overview of Equipment Room Layouts
  4. Overview of Labeling Formats
  5. Overview of Test Results and their meaning
  6. Overview of Documentation
- C. Training shall be held at Project Site and shall be conducted during normal working hours.
- D. Training session duration shall be not less than one (1) h.
  1. Provide (1) such sessions.
  2. Coordinate with owner to schedule session(s). Provide adequate notification to allow owner to schedule staff.
- E. Attendance shall be by owner staff.
  1. Number of Students per session shall be 6.
  2. Materials shall be provided for the number of students indicated.
- F. Provide example course materials and instructor background in advance of training session(s).
- G. Owner may videotape session(s) for use as future refresher materials for owner technical staff.

END OF SECTION

SECTION 27 11 00 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 GENERAL

1.01 SCOPE

- A. This section details product and execution requirements for Communications Equipment Room Fittings for Communications Systems.

1.02 DESCRIPTION

- A. Communications Equipment Room Fittings include:
  - 1. Patch Panels
- B. Refer to Project Drawings for Equipment Room layout and equipment placement.

1.03 RELATED WORK

- A. Refer to Section 27 0000 - General Communications Requirements which identifies related specification sections in this and other Divisions (if applicable).

1.04 REFERENCES AND STANDARDS

- A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.
- B. Related Division 27 Sections include:
  - 1. Section 27 0000 - General Communications Requirements
  - 2. Section 27 0528.29 - Hangers and Supports for Communications Systems
  - 3. Section 27 0553 - Communications Systems Identification
  - 4. Section 27 1000 - Structured Cabling
  - 5. Section 27 1500 - Communications Horizontal Cabling
- C. Related sections in other Divisions of Work:
  - 1. Refer to individual technical sections identified above (if applicable).

1.05 DEFINITIONS

- A. Refer to Section 27 0000 - General Communications Requirements and Section 27 1000 - Structured Cabling which provide information on Definitions used in this and related sections.

1.06 ABBREVIATIONS AND ACRONYMS

- A. Refer to Section 27 0000 - General Communications Requirements and Section 27 1000 - Structured Cabling which provide information on Abbreviations and Acronyms used in this and related sections.

1.07 WORK BY OWNER

- A. Refer to Section 27 0000 - General Communications Requirements which identifies Work by Owner affecting sub-system(s) covered by this section.

## 1.08 SUBMITTALS

- A. Refer to Section 27 0000 - General Communications Requirements and Section 27 1000 - Structured Cabling which provide general guidelines for product or installation information to be submitted by Contractor.

## 1.09 QUALITY ASSURANCE

- A. Refer to Section 27 0000 - General Communications Requirements and Section 27 1000 - Structured Cabling which identify general quality assurance requirements for the Project.

## 1.10 GUARANTEE

- A. Refer to Division 01, General Conditions, and General Requirements - Guarantee Documents for general warranty requirements.
- B. Refer to Section 27 1000 - Structured Cabling for particular Warranty requirements for Structured Cabling. Those requirements apply to cable and components covered in this section.

## PART 2 PRODUCTS

### 2.01 MODULAR PATCH PANELS

- A. Manufacturers: Refer to System Requirements list in 27 1000
- B. Panels shall:
  - 1. Consist of Modular-to-IDC connector system
  - 2. Be rack-mountable in standard EIA 19" equipment racks
  - 3. Be 2 RUs high
  - 4. Accommodate 48-port modular jacks in two rows of 24-ports
  - 5. Be designed to terminate 4-pair, 100-Ohm UTP cables
  - 6. Have ability to terminate 22-26 AWG plastic insulated, solid and stranded copper conductors.
  - 7. Be designed to maintain cable's pair twists as closely as possible to point of mechanical termination.
  - 8. Have cable support and strain relief devices to secure cables at IDC connector.
    - a. Panel and cable support hardware shall ensure that cabling minimum bend radius requirements are satisfied.
  - 9. Have port identification numbers on both front and rear of panel.
  - 10. Have color-coded pair designations on rear of panel.
- C. Modular Jacks in Panel shall:
  - 1. Be non-keyed, 8 position, 8-conductor (8P8C)
- D. Panels shall meet or exceed TIA Category 6 performance criteria.

## PART 3 EXECUTION

### 3.01 GENERAL

- A. Refer to project Drawings for communications equipment room layout and equipment placement.

- B. New communications equipment rooms must be free from dust, dirt, and other foreign materials before installation of any termination hardware or termination of copper or fiber optic cables.
  - 1. Door to room must be closed during termination if area outside room is not dust-free.
- C. Follow manufacturer's recommended installation and termination practices.
- D. Provide necessary assistance to allow Owner or Carrier personnel to establish service on new cable system.
  - 1. Includes general wiring overview, cable pair identification, and cross connect documentation (if applicable).

### 3.02 MODULAR PATCH PANELS

- A. Provide panels to accommodate an additional 20% growth at each location.
- B. Mount patch panels in 19" equipment racks.
- C. Position cables in sequence of:
  - 1. Telecommunications Outlet ID for horizontal cabling
  - 2. Pair number for backbone cabling
- D. Terminate cables using 568A wiring standard.
- E. Provide horizontal management above and below each patch panel.
- F. Provide minimum of 4 screws to secure each patch panel onto rack.
- G. Bond F/UTP cable shield and drain wire to connecting hardware per manufacturer's instructions. Bond connecting hardware to the Telecommunications grounding system.

### 3.03 FIELD TESTING

- A. General
  - 1. Refer to Section 27 0000 - General Communications Requirements and 27 1000 – Structured Cabling for guidelines regarding documentation requirements.
  - 2. Refer to referenced technical sections for detailed requirements to testing of each cable sub-system.

### 3.04 DOCUMENTATION

- A. General
  - 1. Refer to Sections 27 0000 - General Communications Requirements and 27 1000 – Structured Cabling for guidelines regarding documentation requirements.

END OF SECTION



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SECTION 27 15 00 – COMMUNICATIONS HORIZONTAL CABLING

PART 1 GENERAL

1.01 SCOPE

- A. This section details product and execution requirements for Horizontal (Station) Cabling subsystem for Communications Systems.

1.02 DESCRIPTION

- A. Horizontal cabling subsystem is portion of communication link that connects horizontal or intermediate cross-connect (typically at Telecom Room) and Telecommunications Outlet.
- B. Horizontal Cable types include:
  - 1. 4-pair Copper Unshielded Twisted Pair (UTP)

1.03 RELATED WORK

- A. Related Division 27 Sections include:
  - 1. Section 27 0000 - General Communications Requirements
  - 2. Section 27 0528.29 - Hangers and Supports for Communications Systems
  - 3. Section 27 0553 - Communications Systems Identification
  - 4. Section 27 1000 - Structured Cabling
  - 5. Section 27 1100 - Communications Equipment Room Fittings
- B. Related sections in other Divisions of Work:
  - 1. Refer to individual technical sections identified above (if applicable).

1.04 REFERENCES AND STANDARDS

- A. Refer to Section 27 0000 - General Communications Requirements and Section 27 1000 - Structured Cabling which identifies pertinent References and Standards.

1.05 DEFINITIONS

- A. Refer to Section 27 0000 - General Communications Requirements and Section 27 1000 - Structured Cabling which provide information on Definitions used in this and related Sections.
- B. In this section, "Telecommunications Outlet" is considered to consist of Frame/Faceplate into which Modular Jacks or other couplings snap, Modular Jacks, blanks fitted to unused jack positions, and labeling/identification components.

1.06 ABBREVIATIONS AND ACRONYMS

- A. Refer to Section 27 0000 - General Communications Requirements and Section 27 1000 - Structured Cabling which provide information on Abbreviations and Acronyms used in this and related Sections.

1.07 WORK BY OWNER

- A. Refer to Section 27 0000 - General Communications Requirements which identifies Work by Owner affecting sub-system(s) covered by this section.

## 1.08 SUBMITTALS

- A. Refer to Section 27 0000 - General Communications Requirements and Section 27 1000 - Structured Cabling which provide general guidelines for product or installation information to be submitted by Contractor.
- B. In addition, submit:
  - 1. Samples of each Telecommunications Outlet Faceplate type to confirm color and material.
  - 2. One 3 ft section of each cable type from cable reels sent to site for Engineer's final approval.
    - a. Section shall have manufacturer's cable markings visible.
  - 3. Nominal Velocity of Propagation (NVP) for 4-pair Horizontal Copper Cable.

## 1.09 QUALITY ASSURANCE

- A. Refer to Section 27 0000 - General Communications Requirements and Section 27 1000 - Structured Cabling which identify general quality assurance requirements for the Project.

## 1.10 GUARANTEE

- A. Refer to Division 01, General Conditions, and General Requirements - Guarantee Documents for general warranty requirements.
- B. Refer to Section 27 1000 - Structured Cabling for particular Warranty requirements for Structured Cabling. Those requirements apply to all cable and components covered in this section.

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. Cables and Termination hardware shall be technically compliant with and installed in accordance with referenced TIA documents.
- B. Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of National Electrical Code and shall meet specifications of NEMA (low loss), UL 444, and ICEA (where applicable).
- C. Horizontal (Station) Cable and Termination Components (Jack, Patch Panel) are specified to function as System.
  - 1. Where required for warranty purposes, manufacturers of cabling and termination components used (if more than one) shall recognize each other in their Certification Programs.
- D. 4-Pair Horizontal Copper Cables and Modular Jacks are application independent (e.g. no distinction between "voice" and "data").

### 2.02 4-PAIR HORIZONTAL COPPER CABLE

- A. Manufacturers: Refer to System Requirements list in 27 1000
- B. Cables shall be suitable for installation in environment defined
- C. Cabling shall be packaged to minimize tangling and kinking of cable during installation.

D. Configuration:

1. Number of Pairs: 4 twisted pair
  - a. Pair twists of any pair shall not be same as any other pair.
  - b. Pair twist lengths shall be selected by manufacturer to ensure compliance with crosstalk requirements of TIA 568.
2. Conductors: insulated solid annealed copper pairs
  - a. Category 3 - 5e: 24 AWG
  - b. Category 6 & 6A: 23 AWG
  - c. Pairs of 4-pair cables shall be identified by banded color code in which conductor insulation is marked with dominant color and banded with contrasting color.
    - 1). By pair number, pair colors or dominant band are:
      - a). Pair 1: Tip - White/Blue; Ring - Blue (or Blue/White)
      - b). Pair 2: Tip - White/Orange; Ring - Orange (or Orange/White)
      - c). Pair 3: Tip - White/Green; Ring - Green (or Green/White)
      - d). Pair 4: Tip - White/Brown; Ring - Brown (or Brown/White)
3. Shield: None
  - a. Drain Wire: None
4. Cable Rating: NEC Article 800 Type CMP (as required), UL listed
5. Maximum outside diameter:
  - a. Category 5e: 0.22 inches
  - b. Category 6: 0.25 inches
  - c. Category 6A: 0.28 inches

E. Horizontal Structured Cable:

1. Shall meet or exceed TIA Category 6 performance requirements.
2. Shall incorporate an overall shield.
3. Jacket Color: Blue

2.03 TELECOMMUNICATIONS OUTLET

- A. Manufacturers: Refer to System Requirements list in 27 1000
- B. Connectors (modular jacks, fiber optic couplings and coaxial connectors (as applicable)) shall snap onto faceplate.
  1. In surface-mount designs (if applicable) Jacks and connectors may mount to frame onto which coverplate is mounted.
- C. Work Area Faceplate
  1. Wall-mounted faceplates intended to be used in general work areas shall:
    - a. Be configured to mount on standard, single gang opening when wall mounted.
    - b. Accommodate minimum of 4 modular jacks and connectors.
    - c. Be constructed of high impact plastic (except where otherwise noted).
    - d. Incorporate recessed designation strips at top and bottom of frame for identifying labels.
      - 1). Triple row faceplates with no provisions for labeling of middle outlet row are not acceptable.
      - 2). Designation strips shall be fitted with clear plastic covers.

- 3). Designation strips and covers shall be positioned over faceplate mounting screws.
  2. Faceplate Color: to match electrical device faceplates.
- D. Wall-mount Telephone Faceplate
1. Faceplates intended to be used in locations where wall mounted telephone set is required shall:
    - a. Be stainless steel construction.
    - b. Accommodate 1 modular jack meeting performance requirements for "Voice" jack as defined above.
      - 1). Modular jack shall be positioned to mate with wall-mounted telephone.
    - c. Mount on standard single gang opening.
    - d. Include mating lugs for mounting wall-mounted telephone.
- E. Faceplate - Wireless Access Point Location
1. Faceplates supporting Wireless Access Point (AP) shall:
    - a. Accept 2 modular jacks or connectors.
    - b. Be flush-mounted.
    - c. Be made of High Impact thermoplastic.
  2. Faceplate Color: to match electrical device faceplates.
- F. Faceplate - Surface Raceway
1. Faceplates intended to be used on surface raceway shall:
    - a. Accept 3 modular jacks or connectors.
    - b. Snap into raceway opening and be retained by integral latching tabs.
      - 1). Match standard opening of raceway type(s) to be installed.
    - c. Have an optional extender bracket available to increase mounting depth.
    - d. Be made of High Impact thermoplastic.
      - 1). Raceway faceplate color shall be match color of raceway.

#### 2.04 MODULAR JACK

- A. Manufacturers: Refer to "Telecommunications Outlet" above.
- B. Modular Jacks shall be:
1. 8-position, 8-conductor (8P8C)
  2. Non-keyed
- C. Jacks shall have an attached color-coded wiring instruction label as an aid to installer.
- D. Interface between jack and station cable shall be insulation displacement type contact.
- E. Termination components shall maintain cable's pair twists as closely as possible to point of mechanical termination.
- F. Jack contacts shall have minimum of 50 micro-inches of gold plating.
- G. Jacks shall be supplied with installed dust covers to protect jack opening and internal elements during installation until jack is in use.
1. No damage to Jack pinning shall result from insertion or removal of covers.

- H. Jack shall:
1. Meet or exceed performance requirements of TIA Category 6.
  2. Be color Blue
    - a. Alternately, color-coded Bezel or Icon may be used to identify Jack type.

### PART 3 EXECUTION

#### 3.01 GENERAL

- A. Refer to project Drawings for outlet locations.
- B. Provide Modular Jacks, Coaxial Connectors (if applicable) and Fiber Optic couplings (if applicable) in faceplates as shown on Project Documents.
1. Provide 1 faceplate per Telecommunications Outlet symbol shown on Project Documents.
- C. Maximum 4-pair Category-rated horizontal cable length shall not exceed 295 feet (90 m) measured from horizontal cross-connect (typically at TR) to Telecommunications Outlet.
1. Includes slack required for installation and termination.
  2. Contractor is responsible for installing station cable to avoid unnecessarily long runs.
  3. Any area that cannot be reached within above constraints shall be identified and reported to Engineer prior to installation.
- D. Follow manufacturers recommended termination practices.

#### 3.02 CABLE INSTALLATION AND TERMINATION

- A. General
1. Refer to Section 27 0000 - General Communications Requirements and Section 27 1000 - Structured Cabling for general cable installation requirements.
  2. Provide "Service Loop" for every Horizontal Cable in ceiling above outlet.
    - a. Loop length shall be 3.3 ft
    - b. Total length of 4-pair Category-rated horizontal cable including loop shall not exceed 295 feet (90 m).
    - c. Place loop in ceiling at last support (e.g. J-Hook) before cables enter fishable wall, conduit, surface raceway or box.
    - d. Coil loop in figure 8 configuration.
    - e. Loop radius (minimum) shall be 4X minimum bend radius for cable.
  3. During installation, minimum bend radius shall be eight times outside diameter of UTP cables and 20 times outside diameter of fiber cables.
- B. Horizontal Copper Twisted-Pair Cabling
1. Provide horizontal copper twisted pair cable between horizontal cross connect (typically at Telecommunications Room) and Telecommunications Outlet.
  2. At Telecommunications Outlet, terminate each 4-pair Horizontal Cable on 8P8C Modular Jack.
    - a. Terminating one cable on more than one jack is not allowed.
  3. At horizontal cross-connect, terminate:
    - a. Each 4-pair cable on 8P8C Modular Jack in Patch Panel.
  4. Terminate cables using 568A wiring standard.

5. Cable jacket shall be continuous to within 1/2" of termination.
6. Preserve pair twists to point of termination.
7. Refer to Section 27 1100 - Communications Equipment Room Fittings for termination instructions for Modular Patch Panel and Termination Block.
8. All horizontal structured cabling shall be CMP rated, unless routed in enclosed metallic raceway.

### 3.03 TELECOMMUNICATIONS OUTLET

- A. Faceplates shall be configured to provide connectivity as required by location. Refer to drawings.
- B. Mount modular jacks and connectors into faceplates and secure faceplates to outlet box, raceway or modular furniture.
  1. Use faceplate extender if required to provide adequate clearance between jack and furniture or raceway panel to maintain minimum cable bend radius.
  2. Provide blank(s) in unused jack/connector positions. Match color of blank to faceplate color.
- C. Position Telecommunications Outlet for wall-mounted telephone in area clear of other utilities and wall mounted hardware.
  1. Coordinate with other trades to maintain 8" clear space (minimum) on all sides from faceplate centerline.
- D. MPTL connectors shall be installed following connector manufacturer requirements.
  1. Contractor shall ensure installed MPTL will fit in available space at outlet-end of cable while maintaining cable bend radius requirements.

### 3.04 FIELD TESTING

- A. Refer to Sections 27 0000 - General Communications Requirements and 27 1000 – Structured Cabling for guidelines regarding testing requirements common to all Division 27 Structured Cabling sections.
  1. In addition, refer to sub-sections below for cable type under test.
- B. 4-Pair Horizontal Copper Cable
  1. Test from:
    - a. Horizontal Cross-connect (HC) to Jack at Telecommunications Outlet (TO).
  2. Testing shall be per TIA-568 Permanent Link test configurations.
  3. Maximum length of station cable shall not exceed 300 ft.
  4. Cables shall be free of shorts within pairs, and be verified for Continuity, Pair Validity and Polarity, and Wire Map (Conductor Position on Modular Jack).
    - a. Identify and correct defective, split or mis-positioned pairs.
  5. In addition to above, Performance Testing shall be performed on all cables. Testing of Transmission Performance shall include the following:
    - a. Length
    - b. Insertion Loss / Attenuation
    - c. Pair-to-pair NEXT
    - d. PSNEXT
    - e. Pair-to-pair ELFEXT (Equal Level Far End Cross-talk)
    - f. PSELFEXT

- g. Return Loss
  - h. Propagation Delay
  - i. Delay Skew
6. Test cables to maximum frequency defined by standards covering specified performance category.
  7. Perform Transmission Performance Testing using test instrument designed for testing to specified frequencies.
    - a. Test records shall verify "PASS" on each cable and display specified parameters - comparing test values with standards based "templates" integral to unit.
  8. MPTL cables shall be tested in accordance with TIA-568.2-D, Annex F, and test procedure shall follow recommended guidelines of test equipment manufacturer.
    - a. Select MPTL test limit on test equipment when testing MPTL terminated cables.

### 3.05 DOCUMENTATION

- A. Refer to Sections 27 0000 - General Communications Requirements and 27 1000 – Structured Cabling for documentation guidelines.
- B. Information added by Contractor to Record Drawings relating to Horizontal Cabling shall include cable routes, outlet locations and numbering and other detail necessary to document cable installation.

END OF SECTION



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SECTION 28 31 16 - MULTIPLEXED FIRE DETECTION AND ALARM SYSTEMS

PART 1 GENERAL

1.01 RELATED WORK

- A. Section 21 1314 - Automatic Fire Sprinkler System
- B. Section 26 0000 - General Electrical Requirements
- C. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables
- D. Section 26 0526 - Grounding and Bonding for Electrical Systems
- E. Section 26 0533 - Raceway and Boxes for Electrical Systems
- F. Section 26 0553 - Electrical Systems Identification

1.02 REFERENCE

- A. Work under this section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.03 DESCRIPTION

- A. In general, work consists of:
  - 1. Furnish and install Fire Alarm System devices as shown on plans.
  - 2. System includes:
    - a. Manual Stations
    - b. Heat Detectors
    - c. Smoke Detectors
    - d. Alarm Indicating Devices
    - e. Terminations
    - f. Other necessary material for complete operating systems

1.04 REFERENCE STANDARDS

- A. NBC - 2018 - North Carolina State Building Code
- B. IFC - 2015 - International Fire Code
- C. FM Compliance - Systems and Accessories shall be FM approved.
- D. NECA 305 - Standard for Fire Alarm System Job Practices
- E. NFPA 70 - National Electrical Code
- F. NFPA 72 - National Fire Alarm and Signaling Code
- G. NFPA 101 - Life Safety Code
- H. UL 268 - Smoke Detectors for Fire Protective Signaling Systems
- I. UL 497B - Protectors for Communications and Fire Alarm Circuits

- J. UL 521 - Heat Detectors for Fire Protective Signaling Systems
- K. UL 864 - Control Units for Fire Protective Signaling Systems
- L. UL 1480 - Speakers for Fire Protective Signaling Systems
- M. UL 1481 - Power Supplies for Fire Protective Signaling Systems
- N. UL 1711 - Amplifiers for Fire Protective Signaling Systems

#### 1.05 QUALIFICATIONS

- A. Equipment shall be supplied by company specializing in fire alarm and smoke detection systems with 5 yrs documented experience
- B. Work shall be performed by licensed contractor, regularly engaged in installation and servicing of fire alarm systems.
- C. Furnish proof of 5 yrs documented experience and factory authorization to furnish and install equipment proposed.
- D. Installer shall be trained with manufacturer's certification within the most recent 24 months, except NICET III certification will extend to 36 months.
- E. Contractor shall be located within 100 miles of Project site.

#### 1.06 SUBMITTALS

- A. Submit bill of materials listing part number and quantity of components and devices.
- B. Submit general catalog cutsheets of all devices that are to be provided as part of system. Mark cutsheets with items specific to the project when multiple items are identified.
- C. Submit block diagrams showing layout and operation of entire system.
- D. Submit schematic diagrams, of circuits from field devices to terminal strip(s) associated with control panel.
  - 1. Diagrams shall show schematic wiring of equipment; and connections to be made to devices.
  - 2. Terminal connections in equipment shall be numbered to correspond to diagrams.
  - 3. Wiring diagrams shall be coordinated so that terminal numbering, circuit designation and equipment or device designations are same on drawings.
- E. Submit standby battery power calculations.
- F. Submit sound amplifier and strobe power supply calculations showing current draws for every device and module during standby, alarm and trouble conditions.
- G. Submit voltage drop calculations for both initiating and alarming circuits.
- H. Submit list of device addresses with location labeling as they will appear in 2 line, 40 character display of fire alarm panel and remote annunciator.
- I. Submit to Authority Having Jurisdiction (AHJ):
  - 1. Copy of shop drawings as required to show component locations.
  - 2. Upon receipt of comments from AHJ, make resubmissions if required to make clarifications or revisions to obtain approval.

3. All fees associated with this shall be included in the bid.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Existing Edwards EST.

### 2.02 SYSTEM OPERATIONS

#### A. Alarm Initiation

1. System alarm operation after activation of any manual station, automatic detection device, or sprinkler flow switch to match existing system programming.

### 2.03 MULTIPLEXED PERIPHERAL DEVICES

- A. Devices shall be supervised for trouble conditions.

- B. Failure of device shall not hinder operation of other system devices.

#### C. Device Identification

1. Each intelligent device shall be identified by an address code.
2. Location of end-of-line device shall be indicated on device that containing same.
3. System must verify that proper type device is in place and matches software configuration.

#### D. Intelligent Detector Bases

1. Either base or head shall contain electronic circuits that communicate detector's status (normal, alarm, sensitivity status, trouble) to Control Panel over two wires. Same two wires shall also provide power to base and detector.
2. Contacts between base and head shall be of bifurcated type using spring-type, self-wiping contacts.
3. Base shall have locking capability. Locking feature must be field removable when not required.
4. Upon removal of detector's head, trouble signal shall be transmitted to Control Panel.
5. Detector base shall be sealed against rear airflow entry.
6. Detector base or head shall contain LED(s) that flash when detector is being scanned by Control Panel.
7. LED(s) shall turn on steady when detector is in alarm condition.

#### E. Intelligent Detector Heads - General

1. Intelligent detector heads shall be low-profile type.
2. Heads shall be plug-in units, which mount to common base.
3. Heads shall be 24 VDC type.
4. Heads may be reset by actuating Control Panel reset switch.
5. To minimize false alarms, voltage and RF transient suppression techniques shall be employed.
6. Smoke detectors:
  - a. Listed for sensitivity testing from Control Panel. Sensitivity test results shall be logged and downloaded to printer.
  - b. Include an insect screen.

- c. Communicate actual smoke chamber values to Control Panel.
  - d. Covered with plastic bags after installation to maintain cleanliness. Bags shall be red for quick visual identification for removal at time of occupancy.
- F. Intelligent Photoelectric Smoke Detectors
- 1. Detectors:
    - a. Contain no radioactive material
    - b. Be of solid state photoelectric type and shall operate on light scattering photodiode principle using pulsed infrared LED light.
- G. Intelligent Heat Detectors
- 1. Detectors:
    - a. Be a combination rate-of-rise and fixed temperature (135°F unless noted).
    - b. Sense within temperature range of 32° to 158°F. The control panel shall be capable of sensing either a set point of 135°F, or a rate-of-rise of 15°F per minute for fire sensing.
- H. Manual Stations
- 1. Manual stations:
    - a. Double action
    - b. Constructed of high impact, red Lexan with raised white lettering and smooth high gloss finish
    - c. Contain circuits that communicate station's status (alarm, normal) to Control Panel over two wires
    - d. Mechanically latch upon operation and remain so until manually reset. Stations that use Allen wrenches or special tools to reset shall not be accepted.
    - e. Fitted with screw terminals for field wire attachment
  - 2. Address shall be field programmable on station.

## 2.04 SPEAKER/STROBE DEVICES

- A. Combination Speaker/Strobe Devices
- 1. Speakers:
    - a. Operate on 24 V DC or 75 VRMS circuit
    - b. Include separate wire leads for in/out wiring for each leg of associated signal circuit. Tappings of signal device conductors shall not be acceptable.
    - c. Be suitable for rear mounting behind audio-visual assemblies, which shall be flush or semi-flush mounted, with manufacturer back boxes and flush trim ring.
    - d. Have field adjustable output taps, 3 taps minimum.
    - e. Provide minimum sound pressure level of 85.7 dBA at 10' using 1-watt tap.
    - f. Provide a minimum sound pressure level of 90 dBA at 10' using the 2-watt tap.
    - g. Include a blocking capacitor for line supervision and screw terminal for in-out wiring.
  - 2. Strobes shall be:
    - a. Multi-tap units with taps at 15, 30, 75, and 110 cd.
    - b. Tapped at 15-candela peak power or as noted on drawings.
    - c. Have flash synchronization module on circuit when more than one strobe is visible at a time.
    - d. On separate supervised circuit from speaker circuit.
  - 3. White Lexan lens shall have "FIRE" in red lettering visible from a 180° field of view.

4. Have off-white semi flush housing.
  5. Strobe circuit loading shall be calculated at 75 cd tap for all devices, except in mechanical, interstitial spaces where circuit loading shall be calculated at 110 cd tap
- B. Speaker Devices
1. Speakers without strobe units:
    - a. Include above-listed features
    - b. Flush ceiling mounted white baffle and recessed back box for installation in suspended ceiling system.
    - c. Red baffle with surface mounted back box, furnished by speaker manufacturer, where installed in areas with exposed structure.
    - d. Cast metal grille and back box where installed in mechanical/interstitial spaces.

### PART 3 EXECUTION

#### 3.01 GENERAL

- A. Class A circuiting shall be used.
- B. Installation shall be done in neat, workmanlike manner in accordance with manufacturer's recommendations.
- C. Smoke detectors shall not be mounted until construction is completed.

#### 3.02 RACEWAYS

- A. Fire Alarm Panel risers shall be in conduit system separate from other building wiring.
- B. Wiring shall be in conduit system separate from other building wiring. See Section 26 0533 - Raceway and Boxes for Electrical Systems.
- C. Minimum 3/4" steel raceway.
- D. Contractor shall size conduit and boxes by circular mil size of cable in conduit or box.
- E. Surface access to existing alarm initiating circuits in public areas shall be via surface metal raceways (minimum equivalent to 3/4" conduit) and box extensions.
- F. Existing conduit and surface metal raceway that are not 3/4" size may be reused if found to have adequate space for existing and new conductors.

#### 3.03 CONDUCTORS

- A. Cables and wires shall be provided per manufacturer shop drawings.
- B. Conductors shall be color-coded. Coding shall be consistent through out facility.
- C. Green wire shall be used only for equipment ground.
- D. Control Panel power wiring shall be #12 AWG.
- E. Control Panel shall have #12 AWG equipment ground wire.
- F. Where fire alarm circuits enter or leave building, additional transient 75 to 90 V gas tube protection shall be provided for each conductor.

- G. Cable Detector Loops shall be twisted pair with shield jacket. Shield shall be connected to earth ground only at control panel.
- H. Detector wiring shall not be in same conduit with 120/240 VAC wiring or other high current circuits.
- I. T-taps or branch circuit connections are NOT allowed. Connections are only allowed at devices or in terminal cabinets.
- J. Leave 8" wire tails at each device box.
- K. Wiring of initiating device circuits, alarm horn circuits, and alarm strobe circuits shall be #14 AWG minimum.
- L. Fire alarm cable shall be held in place at device box by means of 2-screw connector, (do not use squeeze or crimp type connectors).
- M. Splices or connections shall be made within approved junction boxes and with approved fittings.
- N. Boxes shall be red and labeled "FIRE ALARM SYSTEM" by decal or other approved markings.
- O. Horn and strobe circuits shall have separate conductors, and shall operate independently of each other.
- P. Tray cable is not acceptable for use as fire alarm systems raceway.

### 3.04 DEVICE MOUNTING

- A. Recommended mounting heights, and requirements are as follows:
  - 1. Fire Alarm Control Panels
    - a. Mount control panel so visual indicators and controls at 60" above floor level.
  - 2. Remote Annunciators
    - a. Mount panel so visual indicators and controls at 60" above floor level.
    - b. Install multi-gang box as required by manufacturer, flush or surface mounted.
  - 3. Audio-Visual Devices
    - a. Install flush, semi-flush or surface mount 6" below finished ceiling or 80" from bottom of device to finished floor.
    - b. No devices protruding 4" or more shall be installed lower than 80".
    - c. Audio/visual devices may be installed on the ceilings in accordance with NFPA 72 - Table 2-A.
    - d. For surface mounting, use manufacture-supplied backboxes and trim plates.
    - e. Mark each device with its circuit number.
  - 4. Manual Stations
    - a. Operable part of manual stations shall be installed not less than 3-1/2' (42") and not more than 4-1/2' (54") above finished floor.
    - b. Manual stations shall be in unobstructed locations.
    - c. For surface mounting, use manufacturers supplied backboxes and trim plates
    - d. Mark unit's address on inside and outside of housing.
  - 5. Heat and Smoke Detectors
    - a. Location of detectors shown on plans is schematic only. Detectors must be located according to code requirements.

- b. Surface mounted detectors shall be installed using back boxes equal to base size. Standard octagon and square boxes are not acceptable.
- c. Detectors shall be located on the highest part of smooth ceiling so that edge of detector is no closer than 4" from sidewall.
- d. Ceilings with beams, joists or soffits that exceed 8" in depth require special planning and closer spacing.
- e. Mount detectors on sidewalls with top of detector no closer than 4" from ceiling and no further away than 12".
- f. Smoke detectors shall not be installed closer than 3' from air supply diffusers.
- g. No detectors shall be installed in direct airflow.
- h. Heat and smoke detectors should be located near center of open area, which they protect.
- i. Mark zone number and ranking of each detector on its base.
- j. For intelligent systems, mark address and loop number on each detector's base.

### 3.05 DEMOLITION

- A. Existing equipment that is removed shall be inventoried and turned over to Owner
- B. Upon inspection by Owner, Contractor shall dispose of equipment that is deemed useless to Owner.
- C. Contractor shall remove abandoned devices and conduit not being reused.

### 3.06 IDENTIFICATION LABELS

- A. Junction boxes shall be painted red and labeled "Fire Alarm."
- B. Circuits must be labeled with name of circuit and area being served by circuit.
- C. Labels shall be permanent, and be machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS SHALL BE ALLOWED.
- D. Labels shall be self-laminating, white/transparent vinyl and be wrapped around cable sheath.
- E. Flag type labels are not allowed.
- F. Labels shall be of adequate size to accommodate circumference of cable being labeled and properly self-laminate over full extent of printed area of label.
- G. Adhesive type labels not permitted except for phase and wire identification.
- H. Wiring color code shall be maintained throughout installation.
- I. Green wire shall be used only for equipment ground.

### 3.07 MANUFACTURER'S SERVICES

- A. Supervision of installation shall be provided by trained service technician from manufacturer of fire alarm equipment.
- B. Technician shall be US certified and have had minimum of 2 yrs of service experience in fire alarm industry.



- C. Technician's name shall appear on equipment submittals, and letter of certification from fire alarm manufacturer shall be sent to project engineer.
- D. Manufacturer's service technician shall be responsible for following items:
  - 1. Pre-installation visit to job site to review equipment submittals and verify method by which system shall be wired.
  - 2. Make periodic job site visits to verify installation and wiring of system.
  - 3. Upon completion of wiring, final connections shall be made under supervision of technician.
  - 4. At time of final checkout, technician shall give operational instructions to Owner and/or his representative.
  - 5. Job site visits shall be dated and documented in writing and signed by Electrical contractor.
  - 6. Discrepancy shall be noted on document and copy kept in system job folder, which shall be available to project Engineer any time during project.

### 3.08 TESTING

- A. Manufacturer's authorized representative shall perform complete functional test of each system and submit written report to Contractor attesting to proper operation of completed system prior to final inspection.
- B. Contractor shall test each device in system before system is considered substantially complete.
- C. Completed fire alarm system shall be fully tested by Contractor in presence of Owner's representative and local Fire Marshal.
- D. Upon completion of successful test, Contractor shall:
  - 1. Certify system to Owner in writing
  - 2. Complete NFPA 1-7.2.1 record of completion form
  - 3. Provide as-builts and O&M manuals
- E. The person that programmed the system must be present for the State Construction Office final inspection.

### 3.09 WARRANTY

- A. Warrant completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of 2 yrs from the date of substantial completion of project.
- B. Post warranty period along with company's name and telephone number inside fire alarm panel.
- C. Warranty service for equipment shall be provided by system supplier's factory trained representative.
- D. Warranty shall include parts, labor, and necessary travel.
- E. Occupied facility shall not be without UL and NFPA approved and fully operational fire alarm system for period longer than 2 h. Emergency response shall be provided within 2 h of notification, to contractor, of failure of system to perform operationally per UL and NFPA standards.
- F. Non-emergency service calls shall be responded to within 24 h of notification to contractor.

- G. Repairs and/or replacement shall be completed within 72 h of time of notification. Other than emergency, actual repairs and/or replacement shall be provided during normal working hours, Monday through Friday, excluding holidays.
- H. If repair and/or replacement cannot be made within prescribed time, other means and methods of protection shall be provided to insure safety of building occupants during which time system is not in compliance with standards. This may involve up to and include hiring Owner approved qualified personnel to stand fire watch, at contractor's expense.

### 3.10 SPECIAL CONSIDERATIONS

- A. Contractor shall refer to Division 01, General Requirements.
- B. Contractor shall notify Owner's security officer 24 h in advance of any zones inoperative for a period of time exceeding 2 h.
- C. Existing fire alarm systems must be returned to full operation at end of each working day, or notification to campus security of what zones are inoperative on a daily basis in writing, hand delivered.

END OF SECTION

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