PROJECT MANUAL

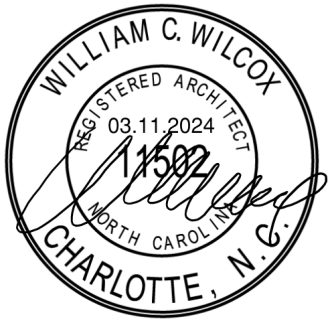
Fayetteville Technical Community College
Building Trades Center Renovation

3211 Bragg Blvd
Fayetteville, NC 28303

FOR:

Facilities Services
2201 Hull Road
Fayetteville, NC 28303

March 12, 2023

ARCHITECT	William C. Wilcox, AIA RA # 11502	
CIVIL	Roy Paul Lorenzen PE # 15384	
STRUCTURAL	Petrina Agnello PE # 41315	
MECHANICAL / PLUMBING ENGINEER	James Currie PE # 31478	

FIRE PROTECTION ENGINEER	James Currie PE # 31478

ELECTRICAL ENGINEER	Dan Boland PE # 38491

END OF DOCUMENT 00 01 01

Fayetteville Technical Community College

Bid # 96-2404_GC-2699 NCCCS # 2699
ADVERTISEMENT FOR BID
03/12/2024

Sealed proposals will be received until **2:00 PM (EST) on Thursday, April 11, 2024**, **in Room 114** of the Thomas R. McLean Administration Building, Fayetteville Technical Community College, 2301 Hull Road, Fayetteville, NC 28303, Attn: Scott M. Meis, Assistant Director of Procurement, for the construction of the

BUILDING TRADES CENTER RENOVATION

Immediately following, bids will be publicly opened and read aloud in Lafayette Hall, 2201 Hull Road, Fayetteville, NC 28303, room 101.

A Pre-Bid meeting will be held on **Tuesday, March 26, 2024, at 10:00 A.M.** in Lafayette Hall at 2201 Hull Road, Fayetteville, NC 28303, room 101. **The pre-bid meeting is mandatory for Prime Bidders.** The meeting will address project specific questions, issues, bidding procedures, bid forms and include a building tour.

A link for downloading complete plans and specifications for this project can be obtained by any bidder that will be submitting a bid to the Owner, by contacting Project Architect Kip Wilcox, AIA, with C Design Inc, 1000 West Morehead, Charlotte, NC at 704-333-0093 or kwilcox@cdesigninc.com during normal business hours.

Single prime proposals will be received from contractors licensed per G.S.87. A bid bond or other bid security is required. Payment and performance bonds will be required of the general contractor who is awarded this project. Minority Business Enterprise (MBE) guidelines must be followed.

Fayetteville Technical Community College encourages participation by HUB firms and supports efforts to ensure and promote opportunities for MBE. A 10% MBE participation goal has been established for this project.

The College reserves the unqualified right to reject any and all proposals and waive any informalities.

Owner Representative:
Fayetteville Technical Community College
Kevin Paul, VP for Facilities and Support Services
2301 Hull Road
Fayetteville, NC 28303
paulk@faytechcc.edu
910-678-8327

BUILDING TRADES CENTER RENOVATION

FAYETTEVEILLE TECHNICAL COMMUNITY COLLEGE

Single Prime Contract:

Bidder:_____

License #:_____

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 proposes and agrees if this proposal is accepted to contract with the **Trustees of Fayetteville Technical Community College** 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**:**

CENTRAL CAMPUS CENTER FOR ARTS TECHNOLOGY

in full in complete accordance with the plans, specifications and contract documents, to the full and entire satisfaction of the **Facilities Services Division of Fayetteville Technical Community College** 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 Contractor	license #	Plumbing Subcontractor	license #
_____		_____	
HVAC Subcontractor	license #	Electrical Subcontractor	license #

Addendum received and used in computing bid:

Addendum No. 1 _____ Addendum No. 2 _____ Addendum No. 3_____ Addendum No. 4_____

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.)

Alternate No. 1 Provide a Lump Sum for items indicated in the Schedule of Alternates under Alternate No. 1 of Section 01 23 00 Schedule of Alternates.

(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 scope of the work all in accordance with the contract documents.

SINGLE PRIME /GENERAL CONTRACT:

A. Unit Price No. 1: **Not Applicable**

ALLOWANCES:

a. Each bidder shall show below the cash amounts included in the Base Bid Price for use at the direction of the Owner.
b. The total for quantity allowances shall be the total cost using Contractor's Unit Prices indicated above and the quantities from Section 01 10 00 General Conditions Part D Allowances.
c. The bidder shall be responsible for determining from the Contract Documents the affects of each Allowance on the Contract Time and/or Contract Sum.
d. The Owner reserves the right to utilize funds identified under Allowances solely at the Owner's discretion and to amend the Contract accordingly during the period of the contract.

B. Quantity Allowance No. 1: **Base Bid to include an allowance of 5% for any unforeseen conditions in this project and itemized as "Construction Contingency". Any unforeseen conditions that would result in a net add Change Order shall be drawn from this contingency allowance. All unused contingency allowance funds shall be returned to the College.**

TOTAL ALLOWANCES TO BE INCLUDED IN BASE BID: _____

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.

MINORITY BUSINESS PARTICIPATION REQUIREMENTS;

Provide with the bid - Under GS 143-128.2(c) the undersigned bidder shall identify **on its bid** (Identity 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 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 documention with the bid or after being notified apparent low bidder may be grounds for rejection of the bid.

Proposal Signature Page

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. _____

(CORPORATE SEAL)

ACCEPTED by Fayetteville Technical Community College

Total amount of accepted by the owner, included base bid and bid alternates:_____

_____
(Agency/Institution)

BY:_____TITLE:_____

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 Fayetteville Technical Community College 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)

GENERAL CONDITIONS OF THE CONTRACT

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; and insurance certificates. All of these items together form the contract.

b. The owner is the Trustees of Fayetteville Technical Community College.

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, 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, and owner.

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 soley 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.

z. Beneficial Occupancy is requested by the owner and is occupancy or partial occupancy of the building after all life safety items have been completed. Life safety items include but not limited to fire alarm, sprinkler, egress and exit lighting, fire rated walls, egress paths and security.

aa. Final Acceptance is the date in which the Owner accepts the construction as totally complete. This includes the 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 red 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 red 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 red 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 (2) copies (1 for the Designer, 1 for the Owner) 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, or owner.

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.

f. 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.

c. 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, 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 and/or special inspector 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 re-inspections 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, and/or special inspector, 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, 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 (singleprime 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 Owner. 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 and owner 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 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. 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. 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 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, and Owner 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 is 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(1st tier subs), or their sub-subcontractors (2nd tier subs, 3rd 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 1st tier sub; 1st tier, 2nd tier, 3rd tier, etc contractors shall be allowed a maximum of 2.5% on the contracted workof 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. 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 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, the contractor may request a mediation in connection with GS 143-128(f1) in the owner's dispute resolution policy.

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 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, 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, 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, and contractor(s). If beneficial occupancy is granted, 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. 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 final inspection. Prior to final inspection, the contractor(s) shall complete all items requiring

corrective measures noted at the Designer final inspection. The designer shall schedule a final inspection at a time and date acceptable to the owner and contractor(s).

b. At the 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 final inspection, the designer and owner 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 final inspection or the owner may invoke Article 28, Owner's Right to Do Work.

3. That the project is not complete and another date for a 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 final inspection and acceptance under Paragraphs b1 or b2 above shall be handled in accordance with Article 42, Guarantee.

e. 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.

f. 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, further requirements for retainage may be waived only so long as work continues to be completed satisfactorily and on schedule.

4. Less previous payments.

5. Current amount due.

a. The contractor, upon request of the designer, shall substantiate the request with invoices of vouchers or payrolls or other evidence.

b. 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.

c. 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 and owner 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 and 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 and owner 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 any time. Bond, security and insurance protection shall continue to be the responsibility of the contractor(s).

d. In the event of beneficial occupancy, retainage of funds due the contractor(s) may be reduced 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 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.

4. Claims filed against the contractor or evidence that a claim will be filed.

5. Evidence that subcontractors have not been paid.

b. 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.

c. 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 progess, defective construction not remedied, disputed work, or thirdparty 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 subsubcontractors 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, 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-ofstate, 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 latest edition of Guideline Criteria for Asbestos Abatement from the NC 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 Owner 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), 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 loss 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 "any 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.

GUIDELINES FOR RECRUITMENT AND SELECTION OF MINORITY BUSINESSES FOR PARTICIPATION IN STATE CONSTRUCTION CONTRACTS

In accordance with G.S. 143-128.2 (effective January 1, 2002) these guidelines establish goals for minority participation in single-prime bidding, separate-prime bidding, construction manager at risk, and alternative contracting methods, on State construction projects in the amount of $300,000 or more. The legislation provides that the State shall have a verifiable ten percent (10%) goal for participation by minority businesses in the total value of work for each project for which a contract or contracts are awarded. These requirements are published to accomplish that end.

SECTION A: INTENT

It is the intent of these guidelines that the State of North Carolina, as awarding authority for construction projects, and the contractors and subcontractors performing the construction contracts awarded shall cooperate and in good faith do all things legal, proper and reasonable to achieve the statutory goal of ten percent (10%) for participation by minority businesses in each construction project as mandated by GS 143-128.2. Nothing in these guidelines shall be construed to require contractors or awarding authorities to award contracts or subcontracts to or to make purchases of materials or equipment from minority-business contractors or minority-business subcontractors who do not submit the lowest responsible, responsive bid or bids.

SECTION B: DEFINITIONS

1. Minority - a person who is a citizen or lawful permanent resident of the United States and who is:
   a. Black, that is, a person having origins in any of the black racial groups in Africa;
   b. Hispanic, that is, a person of Spanish or Portuguese culture with origins in Mexico, South or Central America, or the Caribbean Islands, regardless of race;
   c. Asian American, that is, a person having origins in any of the original peoples of the Far East, Southeast Asia and Asia, the Indian subcontinent, the Pacific Islands;
   d. American Indian, that is, a person having origins in any of the original peoples of North America; or
   e. Female

2. Minority Business - means a business:
   a. In which at least fifty-one percent (51%) is owned by one or more minority persons, or in the case of a corporation, in which at least fifty-one percent (51%) of the stock is owned by one or more minority persons or socially and economically disadvantaged individuals; and
   b. Of which the management and daily business operations are controlled by one or more of the minority persons or socially and economically disadvantaged individuals who own it.

3. Socially and economically disadvantaged individual - means the same as defined in 15 U.S.C. 637. "Socially disadvantaged individuals are those who have been subjected to racial or ethnic prejudice or cultural bias because of their identity as a member of a group without regard to their individual qualities". "Economically disadvantaged individuals are those socially disadvantaged individuals whose ability to compete in the free enterprise system has been impaired due to diminished capital and credit opportunities as compared to others in the same business area who are not socially disadvantaged".

4. Public Entity - means State and all public subdivisions and local governmental units.

5. Owner - The State of North Carolina, through the Agency/Institution named in the contract.

6. Designer – Any person, firm, partnership, or corporation, which has contracted with the State of North Carolina to perform architectural or engineering, work.

7. Bidder - Any person, firm, partnership, corporation, association, or joint venture seeking to be awarded a public contract or subcontract.

8. Contract - A mutually binding legal relationship or any modification thereof obligating the seller to furnish equipment, materials or services, including construction, and obligating the buyer to pay for them.

9. Contractor - Any person, firm, partnership, corporation, association, or joint venture which has contracted with the State of North Carolina to perform construction work or repair.

10. Subcontractor - A firm under contract with the prime contractor or construction manager at risk for supplying materials or labor and materials and/or installation. The subcontractor may or may not provide materials in his subcontract.

SECTION C: RESPONSIBILITIES

1. Office for Historically Underutilized Businesses, Department of Administration (hereinafter referred to as HUB Office).

   The HUB Office has established a program, which allows interested persons or businesses qualifying as a minority business under G.S. 143-128.2, to obtain certification in the State of North Carolina procurement system. The information provided by the minority businesses will be used by the HUB Office to:
   a. Identify those areas of work for which there are minority businesses, as requested.
   b. Make available to interested parties a list of prospective minority business contractors and subcontractors.
   c. Assist in the determination of technical assistance needed by minority business contractors.

   In addition to being responsible for the certification/verification of minority businesses that want to participate in the State construction program, the HUB Office will:
   (1) Maintain a current list of minority businesses. The list shall include the areas of work in which each minority business is interested.
   (2) Inform minority businesses on how to identify and obtain contracting and subcontracting opportunities through the State Construction Office and other public entities.
   (3) Inform minority businesses of the contracting and subcontracting process for public construction building projects.
   (4) Work with the North Carolina trade and professional organizations to improve the ability of minority businesses to compete in the State construction projects.
   (5) The HUB Office also oversees the minority business program by:
      a. Monitoring compliance with the program requirements.
      b. Assisting in the implementation of training and technical assistance programs.
      c. Identifying and implementing outreach efforts to increase the utilization of minority businesses.
      d. Reporting the results of minority business utilization to the Secretary of the Department of Administration, the Governor, and the General Assembly.

2. State Construction Office
   The State Construction Office will be responsible for the following:

   a. Furnish to the HUB Office a minimum of twenty-one days prior to the bid opening the following:
      (1) Project description and location;
      (2) Locations where bidding documents may be reviewed;
      (3) Name of a representative of the owner who can be contacted during the advertising period to advise who the prospective bidders are;
      (4) Date, time and location of the bid opening.
      (5) Date, time and location of prebid conference, if scheduled.

   b. Attending scheduled prebid conference, if necessary, to clarify requirements of the general statutes regarding minority-business participation, including the bidders' responsibilities.

c. Reviewing the apparent low bidders' statutory compliance with the requirements listed in the proposal, that must be complied with, if the bid is to be considered as responsive, prior to award of contracts. The State reserves the right to reject any or all bids and to waive informalities.
d. Reviewing of minority business requirements at Preconstruction conference**.**
e. Monitoring of contractors' compliance with minority business requirements in the contract documents during construction.
f. Provide statistical data and required reports to the HUB Office.
g. Resolve any protest and disputes arising after implementation of the plan, in conjunction with the HUB Office.

3. Owner
Before awarding a contract, owner shall do the following:

a. Develop and implement a minority business participation outreach plan to identify minority businesses that can perform public building projects and to implement outreach efforts to encourage minority business participation in these projects to include education, recruitment, and interaction between minority businesses and non-minority businesses.
b. Attend the scheduled prebid conference.
c. At least 10 days prior to the scheduled day of bid opening, notify minority businesses that have requested notices from the public entity for public construction or repair work and minority businesses that otherwise indicated to the Office for Historically Underutilized Businesses an interest in the type of work being bid or the potential contracting opportunities listed in the proposal. The notification shall include the following:
    1. A description of the work for which the bid is being solicited.
    2. The date, time, and location where bids are to be submitted.
    3. The name of the individual within the owner's organization who will be available to answer questions about the project.
    4. Where bid documents may be reviewed.
    5. Any special requirements that may exist.
d. Utilize other media, as appropriate, likely to inform potential minority businesses of the bid being sought.
e. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.
f. Review, jointly with the designer, all requirements of G.S. 143-128.2(c) and G.S. 143-128.2(f) – (i.e. bidders' proposals for identification of the minority businesses that will be utilized with corresponding total dollar value of the bid and affidavit listing good faith efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award to the State Construction Office.
g. Evaluate documentation to determine good faith effort has been achieved for minority business utilization prior to recommendation of award to State Construction Office.
h. Review prime contractors' pay applications for compliance with minority business utilization commitments prior to payment**.**
i. Make documentation showing evidence of implementation of Owner's responsibilities available for review by State Construction Office and HUB Office, upon request

4. Designer
Under the single-prime bidding, separate prime bidding, construction manager at risk, or alternative contracting method, the designer will:

a. Attend the scheduled prebid conference to explain minority business requirements to the prospective bidders.
b. Assist the owner to identify and notify prospective minority business prime and subcontractors of potential contracting opportunities.
c. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.
d. Review jointly with the owner, all requirements of G.S. 143-128.2(c) and G.S.143-128.2(f) – (i.e. bidders' proposals for identification of the minority businesses that will be utilized with

corresponding total dollar value of the bid and affidavit listing Good Faith Efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award.

e. During construction phase of the project, review "MBE Documentation for Contract Payment" – (Appendix E) for compliance with minority business utilization commitments. Submit Appendix E form with monthly pay applications to the owner and forward copies to the State Construction Office.
f. Make documentation showing evidence of implementation of Designer's responsibilities available for review by State Construction Office and HUB Office, upon request.

5. Prime Contractor(s), CM at Risk, and Its First-Tier Subcontractors
Under the single-prime bidding, the separate-prime biding, construction manager at risk and alternative contracting methods, contractor(s) will:

a. Attend the scheduled prebid conference.
b. Identify or determine those work areas of a subcontract where minority businesses may have an interest in performing subcontract work.
c. At least ten (10) days prior to the scheduled day of bid opening, notify minority businesses of potential subcontracting opportunities listed in the proposal. The notification will include the following:
   (1) A description of the work for which the subbid is being solicited.
   (2) The date, time and location where subbids are to be submitted.
   (3) The name of the individual within the company who will be available to answer questions about the project.
   (4) Where bid documents may be reviewed.
   (5) Any special requirements that may exist, such as insurance, licenses, bonds and financial arrangements.

   If there are more than three (3) minority businesses in the general locality of the project who offer similar contracting or subcontracting services in the specific trade, the contractor(s) shall notify three (3), but may contact more, if the contractor(s) so desires.
d. During the bidding process, comply with the contractor(s) requirements listed in the proposal for minority participation.
e. 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 as required by G.S. 143-128.2(c) and G.S. 143-128.2(f).
f. Make documentation showing evidence of implementation of PM, CM-at-Risk and First-Tier Subcontractor responsibilities available for review by State Construction Office and HUB Office, upon request.
g. Upon being named the apparent low bidder, the Bidder shall provide one of the following: (1) an affidavit (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 applicable goal; (2) if the percentage is not equal to the applicable goal, then documentation of all good faith efforts taken to meet the goal. Failure to comply with these requirements is grounds for rejection of the bid and award to the next lowest responsible and responsive bidder.
h. The contractor(s) shall identify the name(s) of minority business subcontractor(s) and corresponding dollar amount of work on the schedule of values. The schedule of values shall be provided as required in Article 31 of the General Conditions of the Contract to facilitate payments to the subcontractors.
i. The contractor(s) shall submit with each monthly pay request(s) and final payment(s), "MBE Documentation for Contract Payment" – (Appendix E), for designer's review.
j. During the construction of a project, at any time**,** if it becomes necessary to replace a minority business subcontractor, immediately advise the owner, State Construction Office, and the Director of the HUB Office in writing**,** of the circumstances involved. The prime contractor shall make a good faith effort to replace a minority business subcontractor with another minority business subcontractor.

k. If during the construction of a project additional subcontracting opportunities become available, make a good faith effort to solicit subbids from minority businesses.
l. It is the intent of these requirements apply to all contractors performing as prime contractor and first tier subcontractor under construction manager at risk on state projects.

6. Minority Business Responsibilities
While minority businesses are not required to become certified in order to participate in the State construction projects, it is recommended that they become certified and should take advantage of the appropriate technical assistance that is made available. In addition, minority businesses who are contacted by owners or bidders must respond promptly whether or not they wish to submit a bid.

SECTION 4: DISPUTE PROCEDURES
It is the policy of this state that disputes that involves a person's rights, duties or privileges, should be settled through informal procedures. To that end, minority business disputes arising under these guidelines should be resolved as governed under G.S. 143-128(g).

SECTION 5: These guidelines shall apply upon promulgation on state construction projects. Copies of these guidelines may be obtained from the Department of Administration, State Construction Office, (physical address) 301 North Wilmington Street, Suite 450, NC Education Building, Raleigh, North Carolina, 27601-2827, (mail address) 1307 Mail Service Center, Raleigh, North Carolina, 27699-1307, phone (919) 807-4100, Website: www.nc-sco.com

SECTION 6: In addition to these guidelines, there will be issued with each construction bid package provisions for contractual compliance providing minority business participation in the state construction program.

MINORITY BUSINESS CONTRACT PROVISIONS (CONSTRUCTION)

APPLICATION:

The **Guidelines for Recruitment and Selection of Minority Businesses for Participation in State Construction Contracts** are hereby made a part of these contract documents. These guidelines shall apply to all contractors regardless of ownership. Copies of these guidelines may be obtained from the Department of Administration, State Construction Office, (physical address) 301 North Wilmington Street, Suite 450, NC Education Building, Raleigh, North Carolina, 27601-2827, (mail address) 1307 Mail Service Center, Raleigh, North Carolina, 27699-1307, phone (919) 807-4100, Website: http://www.nc-sco.com

MINORITY BUSINESS SUBCONTRACT GOALS:

The goals for participation by minority firms as subcontractors on this project have been set at 10%.

The bidder must identify on its bid, the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit (Affidavit A) listing good faith efforts **or** affidavit (Affidavit B) of self-performance of work, if the bidder will perform work under contract by its own workforce, as required by G.S. 143-128.2(c) and G.S. 143-128.2(f).

The lowest responsible, responsive bidder must provide 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 applicable goal.

OR

Provide Affidavit D, that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, **with documentation of Good Faith Effort, if the percentage is not equal to the applicable goal.**

OR

Provide Affidavit B, which includes sufficient information for the State to determine that the bidder does not customarily subcontract work on this type project.

The above information must be provided as required. Failure to submit these documents is grounds for rejection of the bid.

MINIMUM COMPLIANCE REQUIREMENTS:

All written statements, affidavits or intentions made by the Bidder shall become a part of the agreement between the Contractor and the State for performance of this contract. Failure to comply with any of these statements, affidavits or intentions, or with the minority business Guidelines shall constitute a breach of the contract. A finding by the State that any information submitted either prior to award of the contract or during the performance of the contract is inaccurate, false or incomplete, shall also constitute a breach of the contract. Any such breach may result in termination of the contract in accordance with the termination provisions contained in the contract. It shall be solely at the option of the State whether to terminate the contract for breach.

In determining whether a contractor has made Good Faith Efforts, the State will evaluate all efforts made by the Contractor and will determine compliance in regard to quantity, intensity, and results of these efforts. Good Faith Efforts include:

(1) Contacting 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 or proposal date and notifying them of the nature and scope of the work to be performed.

(2) Making 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 bid or proposals are due.

(3) Breaking down or combining elements of work into economically feasible units to facilitate minority participation.

(4) Working with minority trade, community, or contractor organizations identified by the Office for Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.

(5) Attending any prebid meetings scheduled by the public owner.

(6) Providing assistance in getting required bonding or insurance or providing alternatives to bonding or insurance for subcontractors.

(7) Negotiating in good faith with interested minority businesses and not rejecting 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) Providing 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. Assisting minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.

(9) Negotiating 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) Providing quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

APPENDIX E

MBE DOCUMENTATION FOR CONTRACT PAYMENTS

Prime Contractor/Architect: _____

Address & Phone: _____

Project Name: _____

Pay Application #: _____ Period: _____

The following is a list of payments made to Minority Business Enterprises on this project for the above-mentioned period.

MBE FIRM NAME	* INDICATE TYPE OF MBE	AMOUNT PAID THIS MONTH	TOTAL PAYMENTS TO DATE	TOTAL AMOUNT COMMITTED

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

Date: _____ Approved/Certified By: _____
Name

_____
Title

_____
Signature

SUBMIT WITH EACH PAY REQUEST & FINAL PAYMENT

(Revised on 3/14/2003)

Identification of HUB Certified/ Minority Business Participation

I,_____,
(Name of Bidder)
do hereby certify that on this project, we will use the following HUB Certified/ minority business as construction subcontractors, vendors, suppliers or providers of professional services.

Firm Name, Address and Phone #	Work Type	*Minority Category	**HUB Certified (Y/N)

*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.**

The total value of minority business contracting will be ($)_____.

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:_____

SEAL

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: _____

SEAL

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:_____

SEAL

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 Name)

Project ID#_____ 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:_____

SEAL

State of _____, County of _____

Subscribed and sworn to before me this _____day of _____20____

Notary Public_____

My commission expires _____

AGREEMENT BETWEEN FAYETTEVILLE TECHNICAL COMMUNITY COLLEGE AND CONSTRUCTION CONTRACTOR

THIS **AGREEMENT**, made the _____ day of _____ in the year of 20__ by and between _____, hereinafter called the Party of the First Part, and the Trustees of Fayetteville Technical Community College, 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; Specifications; Accepted Proposal; Contract; Performance Bond; Payment Bond; Power of Attorney; Workmen's Compensation; Public Liability; Property Damage and Builder's Risk Insurance Certificates; 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 _____ consecutive calendar days from said date. 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.

Contractor, Trade or Corporate Name: _____

By (Owner, Partner, or Corp. President or Vice President Only):

Name: _____

Signature: _____

Title: _____

Attest (Corporate Secretary or Assistant Secretary only):

Name: _____

Signature: _____

Title: _____

Corporate Seal:

The Trustees of Fayetteville Technical Community College

By (President or Sr. Vice President for Business and Finance Only):

Name: _____

Signature: _____

Title: _____

Witness:

Name: _____

Signature: _____

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:

Contractor, Trade or Corporate Name: _____

By (Owner, Partner, or Corp. President or Vice President Only):

Name: _____

Signature: _____

Title: _____

Attest (Corporate Secretary or Assistant Secretary only):

Name: _____

Signature: _____

Title: _____

Corporate Seal:

By Surety Company:

Name: _____

Signature: _____

Title (Attorney in Fact): _____

Witness:

Name: _____

Signature: _____

Title: _____

Surety Company Seal:

Countersigned:

Name: _____

Signature: _____

Title (N.C. Licensed Resident Agent): _____

Name of Surety Agency: _____

Address of Surety Agency: _____

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:

Contractor, Trade or Corporate Name: _____

By (Owner, Partner, or Corp. President or Vice President Only):

Name: _____

Signature: _____

Title: _____

Attest (Corporate Secretary or Assistant Secretary only):

Name: _____

Signature: _____

Title: _____

Corporate Seal:

By Surety Company:

Name: _____

Signature: _____

Title (Attorney in Fact): _____

Witness:

Name: _____

Signature: _____

Title: _____

Surety Company Seal:

Countersigned:

Name: _____

Signature: _____

Title (N.C. Licensed Resident Agent): _____

Name of Surety Agency: _____

Address of Surety Agency: _____

N.C. Regional or Branch Office Address: _____

Sheet for Attaching Power of Attorney

Sheet for Attaching Insurance Certificates

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 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

_____
Print or Type Name of Above

My Commission Expires: _____

Seal

NOTE:
This certified statement may be subject to audit.

STATE OF NORTH CAROLINA
SALES AND USE TAX REPORT DETAIL

CONTRACTOR: _____

SUBCONTRACTOR _____ FOR PERIOD: _____

PROJECT: _____

PURCHASE DATE	VENDOR NAME	INVOICE NUMBER	TYPE OF PROPERTY	INVOICE TOTAL	COUNTY TAX PAID	COUNTY OF SALE *
				$	$	
				TOTAL:	$	

* If this is an out-of-state vendor, the County of Sale should be the county to which the merchandise was shipped.

AIA® Document G701™ – 2017

Change Order

PROJECT: *(name and address)*	**CONTRACT INFORMATION:** Contract For: Date:	**CHANGE ORDER INFORMATION:** Change Order Number: Date:
OWNER: *(name and address)*	**ARCHITECT:** *(name and address)*	**CONTRACTOR:** *(name and address)*

THE CONTRACT IS CHANGED AS FOLLOWS:
(Insert a detailed description of the change and, if applicable, attach or reference specific exhibits. Also include agreed upon adjustments attributable to executed Construction Change Directives.)

The original (Contract Sum) (Guaranteed Maximum Price) was	$ _____
The net change by previously authorized Change Orders	$ _____
The (Contract Sum) (Guaranteed Maximum Price) prior to this Change Order was	$ _____
The (Contract Sum) (Guaranteed Maximum Price) will be (increased) (decreased) (unchanged) by this Change Order in the amount of	$ _____
The new (Contract Sum) (Guaranteed Maximum Price), including this Change Order, will be	$ _____
The Contract Time will be (increased) (decreased) (unchanged) by	( ) days.
The new date of Substantial Completion will be	

NOTE: This Change Order does not include adjustments to the Contract Sum or Guaranteed Maximum Price, or the Contract Time, that have been authorized by Construction Change Directive until the cost and time have been agreed upon by both the Owner and Contractor, in which case a Change Order is executed to supersede the Construction Change Directive.

NOT VALID UNTIL SIGNED BY THE ARCHITECT, CONTRACTOR AND OWNER.

ARCHITECT *(Firm name)*	**CONTRACTOR** *(Firm name)*	**OWNER** *(Firm name)*
SIGNATURE	**SIGNATURE**	**SIGNATURE**
PRINTED NAME AND TITLE	**PRINTED NAME AND TITLE**	**PRINTED NAME AND TITLE**
DATE	**DATE**	**DATE**

AIA® Document G716™ – 2004

Request for Information (RFI)

TO: **FROM:**

PROJECT: **ISSUE DATE:** **RFI No.:**

REQUESTED REPLY DATE:

PROJECT NUMBERS: **COPIES TO:**

RFI DESCRIPTION: *(Fully describe the question or type of information requested.)*

REFERENCES/ATTACHMENTS: *(List specific documents researched when seeking the information requested.)*

SPECIFICATIONS **DRAWINGS** **OTHER**

SENDER'S RECOMMENDATION: *(If RFI concerns a site or construction condition, the sender may provide a recommended solution, including cost and/or schedule considerations.)*

RECEIVER'S REPLY: *(Provide answer to RFI, including cost and/or schedule considerations.)*

By: _____ **Date:** _____ **Copies to:** _____

NOTE: This reply is not an authorization to proceed with work involving additional cost, time or both. If any reply requires a change to the Contract Documents, a Change Order, Construction Change Directive or a Minor Change in the work must be executed in accordance with the Contract Documents.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS and REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all Divisions of the Technical Specifications, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Project information.
2. Work covered by Contract Documents.
3. Owner-Furnished/Contractor-Installed products/ materials (OF/CI).
4. Work Under Separate Contracts (Owner Furnished/Owner Installed (OF/OI)).
5. Access to site.
6. Work restrictions.
7. Specification and drawing conventions.

1.3 PROJECT INFORMATION

A. Project Identification: Fayetteville Technical Community College Building Trades Center Renovations

B. Project Address: 3211 Bragg Blvd, Fayetteville, NC 28303

C. Owner: Trustees of Fayetteville Technical Community College.

D. Consultant Identification: The Contract Documents, dated 12-01-2023, were prepared for the Project by C DESIGN Inc. and their design engineer consultants.

E. The Owner has retained the following entities who will be provided professional and technical services during the Contract Period:

1. Special Inspections & Testing: TBD

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and is described, but not limited to, the following:

1. The Interior and Exterior renovation of an existing single –story car dealership for the Owner’s Building Trades Center.
2. Selective Hazardous Materials abatement.
3. Associated site constructions.

B. Contractor shall furnish all material, labor, tools, supplies, equipment, transportation, superintendence, temporary construction of every nature, insurance, taxes, contributions and all services and facilities, unless specifically excepted, and install all materials, items and equipment

required to complete the construction of the Project, as set forth in the Contract Documents and as required to provide complete and operational systems.

C. Type of Contract: Project will be constructed under a Single Prime General contract with the Owner

1.5 PHASED CONSTRUCTION

A. The Work shall be conducted in one phase.

1.6 WORK UNDER OTHER CONTRACTS

A. General: Cooperate fully with Owner's separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

B. Concurrent Work: Owner will award separate contract(s) for certain construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract and are as follows:

C. Interior and Exterior Signage except for the following items that are to be provided in the Contractor's scope:

1. Temporary, accessible ADA braille signage required for obtaining a Temporary Certificate of Occupancy.
2. Permanent Exterior On-Site Traffic /Parking Lot Signage.
3. Permanent and Temporary Road Traffic and Pedestrian Safety signage required by state and local Department of Transportation departments and/or local authorities having jurisdiction.

D. Interior Furniture Systems.

E. Furniture, Fixtures, and Equipment (FFE) identified on the drawings as "OF/OI" or "NIC" except for the following items that are to be provided in the Contractor's scope:

1. Fire retardant wood blocking for wall mounted FFE items.
2. Key Access and Management System

F. Telecommunication System except for the following items that are to be provided in the Contractor's scope:

1. Conduit and pull wire at inaccessible locations and as indicated on the drawings
2. Cable support items such as wire trays and j-hooks
3. Termination devices such as electrical outlet back boxes and cover plates

G. Security Electronics System except for the following items that are to be provided in the Contractor's scope:
1. Conduit and pull wire at inaccessible locations and as indicated on the drawings.
2. Electrical J-boxes and Electrical outlet boxes for the following:

    a. Security cameras

H. Door Access Control System except for the following items that are to be provided in the Contractor's scope:

1. Conduit and pull wire at inaccessible locations and as indicated on the drawings.
2. Electrical J-boxes and Electrical outlet boxes for the following:
   a. Card Readers
   b. Door Access Headend Controller
3. Electrified Hardware and associated electrified power supplies, DPS's, Request to exit sensors

I. Audio-Visual Electronics & Display System except for the following items that are to be provided in the Contractor's scope:
1. Conduit and pull wire at inaccessible locations and as indicated on the drawings.
2. Electrical J-boxes and Electrical outlet boxes for the following:
   a. TV/ Monitor Displays
   b. Projection equipment
3. Fire retardant wood blocking for wall mounted Audio-Visual Electronics & Display items.

1.7 OWNER FURNISHED/ CONTRACTOR INSTALLED (OF/CI) PRODUCTS/ EQUIPMENT

A. Items identified as OF/CI are indicated in the drawings and/or project manual.

B. Unless otherwise stated in the Contract Documents, Contractor's Costs for receiving, handling, storage if required, and installation of material and equipment shall be included in the Contract Sum.

C. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:

1. Coordinate product information with Contractor.
2. Provide for delivery of Owner-furnished products to Project site.
3. Upon delivery, inspect, with Contractor present, delivered items.
   a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
4. Obtain manufacturer's inspections, service, and warranties.
5. Inform Contractor of earliest available delivery date for Owner-furnished products.

D. Contractor's Responsibilities: The Work includes the following, as applicable:

1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
3. Receive, unload, handle, store, protect, and install Owner-furnished products.
4. Providing wood blocking for wall mounted products.
5. Make building services connections for Owner-furnished products.
6. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.

7. Repair or replace Owner-furnished products damaged following receipt.

E. Owner-Furnished/Contractor-Installed (OFCI) Products/ Equipment:

1. Toilet Accessories identified as OFCI (Wall mounted and/or Toilet Partition mounted).

1.8 OWNER FURNISHED/ OWNER INSTALLED (OF/OI) PRODUCTS/ EQUIPMENT

A. Items identified as OF/OI are indicated in the drawings and/or project manual.

B. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:

1. Coordinate product information with Contractor.
2. Provide for delivery of Owner-furnished products to Project site.
3. Upon delivery, inspect delivered items.
   a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
4. Obtain manufacturer's inspections, service, and warranties.
5. Inform Contractor of earliest available delivery date for Owner-furnished products.
6. Store products in Owner’s facilities until Contractor has obtained Temporary or Final Certificate of Occupancy, allowing for Owners installation.
7. Install products.

C. Contractor's Responsibilities: The Work includes the following, as applicable:

1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates and as allowable by authorities having jurisdiction and under temporary or permanently issued Certificate of Occupancy.
2. Coordinate electrical plug in and plumbing requirements of owner’s products
3. Advise Owner when project is ready for Owner’s forces to install Owner-furnished products
4. Protect Owner-furnished products from damage after installation after issuance of Temporary or Final Certificate of Occupancy certificates.

D. Owner-Furnished/Owner-Installed (OF/OI) Products/ Equipment:

1. Appliances in the Break Vending Room #010 identified as OF/OI:
   a. Upright Refrigerator Freezer.
   b. Microwave (Counter Top).
2. Permanent SFIC cores.

1.9 ACCESS TO SITE

A. General: Contractor(s) shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of the Project as well as having access to their storage building.

1.10 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

B. Use of Site: Do not disturb portions of Project site beyond areas in which the Work is indicated above and as shown on the Drawings.

1. Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all time.
2. Tree Protection: Refer to Civil Documents for extent and details for trees to be protected in accordance with the requirements.
3. Conform to Noise Restrictions imposed by Authorities Having Jurisdiction. Limit work that generates noise to conform to decibel levels and hours stipulated by the Noise Ordinance.

C. Smoking is not permitted anywhere on the Project site.

D. Controlled Substances: The use of controlled substances is not permitted anywhere on the Project site.

E. Weapons: Firearms and other weapons are not permitted anywhere on the Project site.

1.11 SPECIFICATION FORMATS AND CONVENTIONS

A. Technical Specifications Format: The Specifications are organized into Divisions and Sections using the 50-division format and Construction Specifications Institute / Construction Specifications Canada (CSI/CSC's) 2018 "Master Format" numbering system.

1. Section Identification: The Technical Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.

B. Technical Specifications Content: The Technical Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Technical Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Technical Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.12 HAZARDOUS MATERIALS

A. Asbestos Containing Materials (ACM):

1. It is **expected** that asbestos containing materials will be encountered in the Selective Demolition Work. Refer to Document 00 31 26 “Existing Hazardous Material Information”. If constructions suspected of containing Asbestos Containing Materials (ACM) other than those already identified in the Asbestos Containing Materials (ACM) Inspection Report are encountered, do not disturb; immediately notify the Architect, and the Owner.

B. Lead Containing Paint:

1. Lead containing paint is **not expected** to be encountered in the Demolition work. Refer to Document 00 31 26 “Existing Hazardous Material Information”, The Contractor and their Demolition subcontractor shall follow all federal, state, and local environmental laws and regulations including OSHA requirements in regards to its disturbance, removal and disposal. The Contractor and their Demolition Subcontractor shall protect their workforce and the Owner’s worksite according to the provisions of 29 CFR 1926-the OSHA Construction Industry Standards during the course of the Work. The Owner considers the Contractor and the Contractor’s Demolition Subcontractors’ adherence to workplace safety and health standards a reasonable precaution to prevent excessive exposure to lead hazards.
2. The Contractor is here-by notified that the Contractor’s strict adherence to the Occupational Health and Environmental Controls Standard for Lead (29 CRF 1926.62) is a requirement of this project. These standards include (but are not limited to), provisions for worker exposure assessments, engineering controls, specialized work practices, housekeeping requirements, written programs, administrative programs, respiratory protection, protective clothing/equipment, hygiene facilities, medical surveillance programs and employee information/training. The Contractor and Subcontractors should understand that the extent of the worker protection provisions required for his / her employees is dictated by the OSHA standards and the nature of the work being performed.

C. Hazardous Materials Abatement: The General Contractor will contract with the following:

1. A qualified, North Carolina accredited Asbestos Abatement Designer to design the abatement program for the removal, transport , and legal disposal of all asbestos containing materials except those specifically indicated herein:

   a. Asbestos Containing Cement Board located at areas of the project building’s exterior fascia, exterior soffits and roof parapet walls.
   b. Asbestos Containing Sealants located at perimeters of the project building’s exterior aluminum windows.

2. A qualified, North Carolina accredited Asbestos Abatement Designer to design a worker safety program to

   a. Asbestos Containing Cement Board located at areas of the project building’s exterior fascia, exterior soffits and roof parapet walls.

b. Asbestos Containing Sealants (interior and exterior) located at perimeters of the project building's exterior aluminum windows.

3. A qualified, licensed North Carolina hazardous materials abatement contractor for the removal, transport and legal disposal of hazardous materials such as ACM, mercury containing thermostats, mercury containing fluorescent tubes, and the removal of lighting ballasts containing PCB's at the beginning of the Project to occur prior to any other work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to the Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Lump Sum Allowance.
2. Contingency Allowance.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise the Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.4 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

A. Coordinate allowance items with other portions of the Work.

1.6 LUMP-SUM ALLOWANCES (LS)

A. Include, as a line item on the Bid Form, a lump sum, cash allowance for each of the Lump Sum Allowance (LS) items indicated in the Schedule of Allowances and to be included in the Base Bid.

B. Allowances shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

C. Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials under allowance shall be included as part of the of the allowance, unless specifically indicated otherwise.

D. Any unused portion of the allowances remaining at the completion of the Contract will revert back to the Owner as a credit.

1.7 CONTINGENCY ALLOWANCES

A. Included as a line item on the Bid Form is a Contingency Allowance to be added to the Base Bid. Any unused portion of the Contingency Allowance remaining at the completion of the Contract will revert back to the Owner as a credit. The Owner reserves the right to modify the Contingency Allowance prior to the award of the Contract.

B. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

C. Contractor's overhead, profit, and related costs for products and equipment under the contingency allowance are included in the allowance. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

D. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and overhead and profit margins.

E. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF LUMP SUM ALLOWANCES

A. Lump Sum Allowances: Include as a line item on the Bid Form, a lump sum allowance for the each of the items indicated below that are included in the Base Bid Amount.

1. Allowance No. LS-1: Fabric Material for Upholstered Bench Seat and Bench Back Cushions (refer to Section 12 62 00.13 “Upholstered Seat Cushions”)

    a. Include a lump sum allowance of $1,200.00 for fabric material including waste material and attic stock.

3.4 SCHEDULE OF CONTINGENCY ALLOWANCES

A. Contingency Allowance:

1. Include a contingency allowance of 5% of the Base Bid Amount indicated on the Bid Form for additional Work as directed by the Architect for the Owner’s purposes.

END OF SECTION 01 21 00

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: A lump sum amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF OWNER PREFERRED ALTERNATES

A. **Owner Preferred Alternate No. 1**: Provide a lump sum amount to provide the University's preferred brands of door hardware, for technical reasons per North Carolina General Statute G.S.133-3, in order to match campus keying standards, parts sparing of existing hardware and to afford compatibility with the existing electronic building security system:

1. Best Locksets, Electrified Locksets and Passage Sets in lieu of any other brand of locksets, electrified Locksets or passage sets

END OF SECTION 01 23 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for substitutions after the award of the Contract.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use facsimile of form provided in the Project Manual.
2. Documentation: Show compliance with requirements for substitutions. and the following, as applicable:

    a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. Certificates and qualification data, where applicable or requested.

g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
n. Non-Compliance with the specified procedural and documentation requirements are cause for rejection.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 14 days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 7 days of receipt of request, or 7days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Modify or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than 20 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

    a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    b. Substitution request is fully documented and properly submitted.
    c. Requested substitution will not adversely affect Contractor's construction schedule.
    d. Requested substitution has received necessary approvals of authorities having jurisdiction.
    e. Requested substitution is compatible with other portions of the Work.
    f. Requested substitution has been coordinated with other portions of the Work.
    g. Requested substitution provides specified warranty.
    h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Architect may consider requests for substitution if received within 60 days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Architect and/or the Owner.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

    a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume.
    b. Requested substitution does not require revisions to the Contract Documents.
    c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    d. Substitution request is fully documented and properly submitted.
    e. Requested substitution will not adversely affect Contractor's construction schedule.
    f. Requested substitution has received necessary approvals of authorities having jurisdiction.
    g. Requested substitution is compatible with other portions of the Work.
    h. Requested substitution has been coordinated with other portions of the Work.
    i. Requested substitution provides specified warranty.
    j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

REFER TO ATTACHED SUBSTITUTION REQUEST FORM

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POST-BID AWARD SUBSTITUTION REQUEST FORM

Project: FAYETTEVILLE TECHNICAL COMMUNITY COLLEGE
FTCC BUILDING TRADES CENTER RENOVATION

C DESIGN Inc. Proj. No.: **#0604-0639**

To: C DESIGN Inc.

1000 West Morehead St.
Suite 170
Charlotte, NC 28208

Fax: 704-333.0083

Attn.: Kip Wilcox
Kwilcoxi@cdesigninc.com

Requested by: _____

Contract For: _____

Substitution Request Date: _____

Specification Section Name: _____

Section Number & Paragraph _____

Related Drawings: _____

Specified Product
(List name/description; model no.; manufacturer): _____

Required Information for *Specified* Product:	Attached: (Check boxes)
Point by Point Comparative Product Data	☐
Tests	☐
Reports	☐
Product Data/ Drawings	☐
Samples (Where Applicable)	☐

Proposed Product
(List trade name/description; model no.; manufacturer): _____

Required Information for *Proposed* Product:	Attached: (Check boxes)
Point by Point Comparative Product Data	☐
Tests	☐
Reports	☐
Product Data/ Drawings	☐
Samples (Where Applicable)	☐

List of Related Proposed Changes/Modifications:

Differences between proposed substitution and specified product:

Proposed product/fabrication method affects other parts of the Work

☐ No

☐ Yes

If yes explain:

The Undersigned certifies that:

1. The Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product as utilized for this project, except as noted herein.

2. The Qualifications of manufacturer, installer, and other specified parties meet the specified qualifications.

3. The same warranty will be furnished for proposed substitution as for specified product.

4. The same maintenance service and source for replacement parts, as applicable, is available as that specified.

5. The Proposed substitution does not affect dimensions and functional clearances, except as noted herein.

For the Contractor:

Submitted by: _____

Signed: _____

Firm: _____

Telephone: _____

For the Manufacturer:

POST-BID AWARD SUBSTITUTION REQUEST FORM

Submitted by: _____

Signed: _____

Firm: _____

Telephone: _____

For C DESIGN Inc. use only:

- ☐ Substitution approved. _____
- ☐ Substitution approved as noted _____
- ☐ Substitution rejected - Use specified materials.

By: _____ Date: _____

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POST-BID AWARD SUBSTITUTION REQUEST FORM

Project: FAYETTEVILLE TECHNICAL COMMUNITY COLLEGE
FTCC BUILDING TRADES CENTER RENOVATION

C DESIGN Inc. Proj. No.: **#0604-0639**

To: C DESIGN Inc.

1000 West Morehead St.
Suite 170
Charlotte, NC 28208

Fax: 704-333.0083

Attn.: Kip Wilcox
Kwilcoxi@cdesigninc.com

Requested by: _____

Contract For: _____

Substitution Request Date: _____

Specification Section Name: _____

Section Number & Paragraph _____

Related Drawings: _____

Specified Product
(List name/description; model no.; manufacturer): _____

Required Information for *Specified* Product:	Attached: (Check boxes)
Point by Point Comparative Product Data	☐
Tests	☐
Reports	☐
Product Data/ Drawings	☐
Samples (Where Applicable)	☐

Proposed Product
(List trade name/description; model no.; manufacturer): _____

Required Information for *Proposed* Product:	Attached: (Check boxes)
Point by Point Comparative Product Data	☐
Tests	☐
Reports	☐
Product Data/ Drawings	☐
Samples (Where Applicable)	☐

List of Related Proposed Changes/Modifications:

Differences between proposed substitution and specified product:

Proposed product/fabrication method affects other parts of the Work

☐ No

☐ Yes

If yes explain:

The Undersigned certifies that:

1. The Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product as utilized for this project, except as noted herein.

2. The Qualifications of manufacturer, installer, and other specified parties meet the specified qualifications.

3. The same warranty will be furnished for proposed substitution as for specified product.

4. The same maintenance service and source for replacement parts, as applicable, is available as that specified.

5. The Proposed substitution does not affect dimensions and functional clearances, except as noted herein.

For the Contractor:

Submitted by: _____

Signed: _____

Firm: _____

Telephone: _____

For the Manufacturer:

POST-BID AWARD SUBSTITUTION REQUEST FORM

Submitted by: _____

Signed: _____

Firm: _____

Telephone: _____

For C DESIGN Inc. use only:

- ☐ Substitution approved. _____
- ☐ Substitution approved as noted _____
- ☐ Substitution rejected - Use specified materials.

By: _____ Date: _____

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SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:

1. Section 01 25 00 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
2. Section 01 31 00 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
    e. Quotation Form: Use forms acceptable to Architect.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 01 25 00 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Architect.

1.5 ADMINISTRATIVE CHANGE ORDERS –NOT USED

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:
   1. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
   2. Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule

   1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
   2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
   3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
   4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
   5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract, as described in Section 01 10 00 "Summary."

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

   1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Owner's name.
c. Owner's Project number.
d. Name of Architect.
e. Architect's Project number.
f. Contractor's name and address.
g. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703.
3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:

a. Related Specification Section or division.
b. Description of the Work.
c. Name of subcontractor.
d. Name of manufacturer or fabricator.
e. Name of supplier.
f. Change Orders (numbers) that affect value.
g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.

1) Labor.
2) Materials.
3) Equipment.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

a. Differentiate between items stored on-site and items stored off-site.

6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
7. Purchase Contracts: Provide a separate line item in the schedule of values for each Purchase contract. Show line-item value of Purchase contract. Indicate Owner payments or deposits, if any, and balance to be paid by Contractor.
8. Overhead Costs, Separate Line Items: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
9. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
10. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
11. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architect and paid for by Owner.

B. Payment Application Times: Submit Application for Payment to Architect by the 10th of each month. The period covered by each Application for Payment is one month, ending on the last day of the month.

1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit five signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment to subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
5. Products list (preliminary if not final).
6. Sustainable design action plans, including preliminary project materials cost data.
7. Schedule of unit prices.
8. Submittal schedule (preliminary if not final).
9. List of Contractor's staff assignments.
10. List of Contractor's principal consultants.
11. Copies of building permits.
12. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
13. Initial progress report.
14. Report of preconstruction conference.
15. Certificates of insurance and insurance policies.
16. Performance and payment bonds.

I. Application for Payment at Final Completion: After Architect issues the Certificate of Final Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as complete.

1. Include documentation supporting claim that the Work is complete and a statement showing an accounting of changes to the Contract Sum.

    a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 01 77 00 "Closeout Procedures."

2. This application shall reflect Certificate(s) of Final Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Certification of completion of final punch list items.
3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
4. Updated final statement, accounting for final changes to the Contract Sum.
5. AIA Document G706.
6. Evidence that claims have been settled.
7. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Final Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
8. Final liquidated damages settlement statement.
9. Proof that taxes, fees, and similar obligations are paid.
10. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

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SECTION 01 31 00 – PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General project coordination procedures.
2. Administrative and supervisory personnel.
3. Coordination drawings.
4. Requests for Information (RFIs).
5. Project meetings.

1.3 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information from each other during construction.

1.4 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.

4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.
9. Commissioning Services.
10. Project closeout activities.

1.5 KEY PERSONNEL

A. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI to the Construction Manager in the form specified.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow ten working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

D. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including the following:

a. Tentative construction schedule.
b. Phasing.
c. Critical work sequencing and long-lead items.
d. Designation of key personnel and their duties.
e. Lines of communications.
f. Procedures for processing field decisions and Change Orders.
g. Procedures for RFIs.
h. Procedures for testing and inspecting.
i. Procedures for processing Applications for Payment.
j. Distribution of the Contract Documents.
k. Submittal procedures.
l. Sustainable design requirements.
m. Preparation of record documents.
n. Use of the premises
o. Work restrictions.
p. Working hours.
q. Owner's occupancy requirements.
r. Responsibility for temporary facilities and controls.
s. Procedures for moisture and mold control.
t. Procedures for disruptions and shutdowns.
u. Construction waste management and recycling.
v. Parking availability.
w. Office, work, and storage areas.
x. Equipment deliveries and priorities.

y. First aid.
z. Security.
aa. Progress cleaning.

4. Minutes: The Contractor is responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: The Contractor shall conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Owner and Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility problems.
k. Time schedules.
l. Space and access limitations.
m. Testing and inspecting requirements.
n. Installation procedures.
o. Coordination with other work.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: General Contractor will schedule and conduct a Project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Final Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of record documents.

b. Procedures required prior to inspection for Final Completion and for final inspection for acceptance.
c. Submittal of written warranties.
d. Requirements for preparing sustainable design documentation.
e. Requirements for preparing operations and maintenance data.
f. Requirements for demonstration and training.
g. Preparation of Contractor's punch list.
h. Procedures for processing Applications for Payment at Final Completion and for final payment.
i. Submittal procedures.
j. Coordination of separate contracts.
k. Owner's partial occupancy requirements.
l. Installation of Owner's furniture, fixtures, and equipment.
m. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at monthly intervals. At certain critical times it may be necessary to conduct progress meetings on a bi-weekly basis.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner**,** Owner's Commissioning Authority and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of proposal requests.
15) Pending changes.

16) Status of Change Orders.
17) Pending claims and disputes.
18) Documentation of information for payment requests.

4. Minutes: The Architect will responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: The Contractor shall conduct Project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: Each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
c. Review present and future needs of each contractor present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Change Orders.

3. Reporting: The Contractors shall record meeting notes and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.
a. Copies of Coordination Meeting Notes shall be distributed to the Owner and Architect.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

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SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Start-up construction schedule.
2. Contractor's construction schedule.
3. Weekly construction reports.
4. Material location reports.
5. Field condition reports.
6. Special reports.

B. Related Sections:

1. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
2. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 INFORMATIONAL SUBMITTALS

A. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:

1. Scheduled date for first submittals
2. Specification Section Number and Title.
3. Submittal category (action or informational).
4. Name of subcontractor.
5. Description of Work covered.
6. Scheduled dates for submittal to the Architect.
7. Scheduled dates for Architect’s Final Release or Approval.

B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

C. Daily Construction Reports: Submit at weekly intervals.

D. Material Location Reports: Submit at weekly intervals.

E. Field Condition Reports: Submit at time of discovery of differing conditions.

F. Special Reports: Submit at time of unusual event.

1.4 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include not less than 15 days for startup and testing.

5. Final Completion: Indicate completion in advance of date established for Final Completion, and allow time for Architect's administrative procedures necessary for certification of Final Completion.
6. Punch List and Final Completion: Include not more than 30 days for punch list and final completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
6. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Partial occupancy before Final Completion.
    e. Use of premises restrictions.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. Environmental control.

7. Construction Areas: Identify each major area of construction for each major portion of the Work. Insert a list of major areas here if specific scheduling is required. List might include nonbuilding work, such as roads, parking, landscape development, and similar work.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Final Completion, and final completion.

F. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.

1. Refer to Division 01 Section "Payment Procedures" for cost reporting and payment procedures.

G. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered RFIs.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.

H. Recovery Schedule: When periodic update indicates the Work is 5 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule.

I. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's construction schedule within 14 days of date established for the Notice to Proceed. Base schedule on the start-up construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.4 REPORTS

A. Weekly Construction Reports: Prepare a weekly construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. Equipment at Project site.
3. Material deliveries.
4. High and low temperatures and general weather conditions, including presence of rain or snow.
5. Accidents.
6. Meetings and significant decisions.
7. Unusual events (refer to special reports).
8. Stoppages, delays, shortages, and losses.
9. Emergency procedures.
10. Orders and requests of authorities having jurisdiction.
11. Change Orders received and implemented.
12. Construction Change Directives received and implemented.
13. Services connected and disconnected.
14. Equipment or system tests and startups.
15. Partial completions and occupancies.
16. Final Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, and response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections:

1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Division 01 Section "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as action submittals.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as informational submittals.

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

E. Architect: The architect or the architect’s consulting engineer.

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Action, informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled dates for purchasing.
    h. Scheduled dates for installation.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic copies of CAD Revit Drawings of the Contract Drawings will be provided by Architect and its Consulting Design Engineers for Contractor's use in preparing submittals.

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.

    a. Architect or its Consultant’s makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

D. Identification and Information: Place a permanent label or title block on each paper copy submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name of Owner
    d. Name of Architect.
    e. Name of Contractor.
    f. Name of subcontractor.
    g. Name of supplier.
    h. Name of manufacturer.
    i. Submittal number or other unique identifier, including revision identifier.

        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

    j. Number and title of appropriate Specification Section.
    k. Drawing number and detail references, as appropriate.
    l. Location(s) where product is to be installed, as appropriate.
    m. Other necessary identification.

E. Identification and Information: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.

    a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-06 10 00.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-06 10 00.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Include the following information on an inserted cover sheet:

    a. Project name.
    b. Date.
    c. Name of Owner
    d. Name and address of Architect.
    e. Name of firm or entity that prepared submittal.
    f. Name of subcontractor.
    g. Name of supplier.
    h. Name of manufacturer.
    i. Number and title of appropriate Specification Section.
    j. Drawing number and detail references, as appropriate.
    k. Location(s) where product is to be installed, as appropriate.
    l. Related physical samples submitted directly.
    m. Other necessary identification.

5. Include the following information as keywords in the electronic file metadata:

    a. Project name.
    b. Number and title of appropriate Specification Section.
    c. Manufacturer name.
    d. Product name.

F. Options: Identify options requiring selection by the Architect.

G. Deviations: Identify deviations from the Contract Documents on submittals.

H. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

I. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.
1. Transmittal Form: Provide locations on form for the following information:

    a. Project name.
    b. Date.

c. Destination (To:).
d. Source (From:).
e. Names of subcontractor, manufacturer, and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Specification Section number and title.
i. Indication of full or partial submittal.
j. Drawing number and detail references, as appropriate.
k. Transmittal number, numbered consecutively.
l. Submittal and transmittal distribution record.
m. Remarks.
n. Signature of transmitter.

J. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

K. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

L. Use for Construction: Use only final submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Action Submittals: Submit 7 paper copies of each submittal, unless otherwise indicated. Architect will return 3 copies.
   a. The Contractor is encouraged to provide submittals in electronic pdf format where practical.

2. Informational Submittals: Submit 7 paper copies of each submittal, unless otherwise indicated. Architect will not return copies.

   a. The Contractor is encouraged to provide submittals in electronic pdf format where practical.

3. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

5. Test and Inspection Reports Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.
b. Manufacturer's product specifications.
c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Submit Shop Drawings in the following format:

a. PDF electronic file.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

a. Number of Samples: Submit 4 full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

2. Samples for Verification: Submit 3 full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing

color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit three sets of Samples. Architect will retain one Sample sets; remainder will be returned.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least 5 sets of paired units that show approximate limits of variations.

E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

F. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.

G. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

H. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

I. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

J. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

K. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

L. Product Test Reports: Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

M. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

N. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

O. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed

before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

P. Field Test Reports: Submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 01 Section "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

E. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

F. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01 33 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

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

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Preconstruction Testing: Tests and inspections performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

C. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

D. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.

E. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

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

1.6 QUALITY ASSURANCE

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

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.

1.7 QUALITY CONTROL

A. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified. Third party testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. Manufacturer’s Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

C. Manufacturer’s Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. “Approved Equal”: Product and/or Manufacturer that is approved by the Architect either:

1. Prior to the Bid by means of the Substitution Request Procedures as prescribed in the Instructions to the Bidders or any supplemental Instructions to the Bidders document.
2. After the award of the Contract in accordance to Section 01 25 00 “Substitution Procedures”.

D. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

E. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

F. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

G. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

H. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

I. "Provide": Furnish and install, complete and ready for the intended use.

J. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

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

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00 TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.3 DEFINITIONS

A. Permanent Enclosure: As determined by the Architect, permanent or temporary roofing is complete, insulated and weathertight; exterior walls are insulated and weathertight.

1.4 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

C. Water from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

D. Electric Power Service is not available from Existing System: Provide temporary power including connections and extensions of services as required for construction operations.

1.5 SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1.6 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.7 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Vehicular Chain-Link Fencing Swing Gates at Laydown Enclosure: Minimum 2-inch, 0.148-inch thick, galvanized steel, chain-link fabric fencing gates; minimum 6 feet high with galvanized steel pipe hinge posts with minimum embedment depth of 3’-0” feet; minimum 2-7/8-inch- OD heavy duty hinge posts and gate frame of galvanized steel pipes and all accessories. Provide with post hinges, throw / cane bolts, yokes for chain locking, galvanized steel lock chain and high security padlock. Provide 2 extra keys to Owner for Owner access.

B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts, with 1-5/8-inch OD top and bottom rails and all accessories. Provide galvanized steel bases with bagged ballast for supporting posts.

C. Concrete of mix required design for embedment of gate hinge posts at Laydown Enclosure.

D. Asphalt for repair of holes in pavement made for temporary Vehicular Chain-Link Fencing Swing Gates at Laydown Enclosure.

2.2 TEMPORARY FACILITIES

A. Common-Use Field Office: Not Required.

1. Owner will provide a meeting room off-site of the Project Site for Monthly meetings.
2. All other meetings shall be conducted in suitable area in or around project site.

B. Provide chain link fencing with vehicular and pedestrian gates around building and laydown area within the Project site.

1. Maintain fencing and gates in good working condition throughout the duration of the project.

2. Fencing and fencing supports shall not encroach on public sidewalks at any time.

3. Remove fencing and gates when building and site are substantially complete.

4. Use of portable, ballasted fence posts for enclosures are allowable. Provide adequate ballasted weights on project side of fence to prevent tip over for high winds.

5. Vehicular/ Personnel Gates : Move sections of portable fences for daily construction and personnel access; provide means of locking sections together to prevent entry during periods when jobsite is closed; coordinate with local Fire Marshal for emergency access to project site

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service if available.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Locate temporary toilets and wash facilities dumpsters to be hidden from view from main public roads.

D. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

F. Electric Power Service: Provide temporary power for all construction activities.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

3.3 SUPPORT FACILITIES INSTALLATION

A. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

B. Drainage: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

C. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs with Owner's Name, Project Name and Architect and Consulting Engineering Firm Names, if permitted by Owner
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

D. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal." Locate dumpsters to be hidden from view from main public roads.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Division 01 Section "Summary."

B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and specifications and requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.

2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from the project site during the course of the project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
5. Comply with the erosion and sediment control plan developed by the Civil Engineer.

C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

D. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion. Refer to Civil / Landscaping requirements.

E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

F. Temporary Chain Link Site Fencing. Erect fencing enclosures as indicated and/or specified herein.

G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

H. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.5 OWNER OCCUPIED SITE AREAS:

A. The Owner will require access in and out of the site to access their standalone storage building located on the property of the Project Site.

B.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired. Repair

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns.
3. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
4. Repair or replace on-site concrete paving, concrete curbs/gutter, concrete retaining walls, and asphalt paving in parking lots and drives damaged by Contractor's construction activities. Repair asphalt holes made by temporary gate installations.
5. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 01 50 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties.

B. Related Sections:

1. Division 01 Section "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1.4 ACTION SUBMITTALS

A. Product Substitution Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

C. Storage:
1. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. Refer to Divisions 02 through 49. Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.

C. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Progress cleaning.
5. Protection of installed construction.
6. Correction of the Work.
7. Cutting and Patching.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

C. Final Property Survey: Submit 5 copies showing the Work performed and record survey data.

1.4 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from the Architect before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

    a. Water, moisture, or vapor barriers, unless required as a result of corrective action stemming from failure of Commissioning the Building Envelope testing.
    b. Membranes and flashings, unless required as a result of corrective action stemming from failure of Commissioning the Building Envelope testing.
    c. Exterior curtain-wall construction.
    d. Equipment supports.
    e. Piping, ductwork, vessels, and equipment.
    f. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

1.5 WARRANTY

A. Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to the Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

    a. Description of the Work.
    b. List of detrimental conditions, including substrates.
    c. List of unacceptable installation tolerances.
    d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of the Contractor, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Contractor shall identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of three permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Engage a N.C. land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Final Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Final Completion.

D. Do not install gypsum board of any type unit building is enclosed and protected from precipitation.

E. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.

3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

B. Temporary Support: Provide temporary support of work to be cut.

C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

E. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

F. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

G. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.

B. Site: Maintain Project site free of waste materials and debris.

C. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

D. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls and Division 01 Section "Construction Waste Management and Disposal."

E. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Final Completion.

F. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

G. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Final Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.11 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 00

SECTION 01 74 19 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Recycling nonhazardous construction waste.
   2. Disposing of nonhazardous demolition and construction waste.

B. Related Sections:

   1. Division 31 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.

1.5 PERFORMANCE REQUIREMENTS

A. General: Achieve a goal of end-of-Project rates for salvage/recycling of 50 percent by weight of total non-hazardous solid waste generated construction and demolition material by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

   1. Construction Waste:

a. Site-clearing waste.
b. Concrete
c. Lumber.
d. Wood sheet materials.
e. Wood trim.
f. Metals.
g. Roofing.
h. Insulation.
i. Gypsum board.
j. Piping.
k. Electrical conduit.
l. Packaging: Regardless of salvage/recycle goal indicated in paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Plastic pails.

m. Used beverage containers from construction workers and other authorized persons on site.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to the requirements of this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with Division 01 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.

B. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be recycled from general, non-recyclable waste.
2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Remove recyclable waste off Owner's property and transport to recycling receiver that will sort and process recyclable waste.

3.3 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

END OF SECTION 01 74 19

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Final Completion procedures.
2. Final completion procedures.

B. Related Sections:

1. Division 01 Section "Execution" for progress cleaning of Project site.
2. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
3. Divisions 02 through 49 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 FINAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Final Completion, complete the following. List items below that are incomplete with request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases. Prepare and submit Project Record Documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
5. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.

B. Inspection: Submit a written request for inspection for Final Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Final Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Submit certified copy of Architect's Final Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1.6 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Final Completion is indicated.

A. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.

B. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor. Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide table of contents at beginning of document

PART 2 - PRODUCTS

2.1 MATERIALS

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

1. Use cleaning products that meet Green Seal GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Final Completion for entire Project or for a portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
c. Remove tools, construction equipment, machinery, and surplus material from Project site.

C. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 01 77 00

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Product maintenance manuals.

B. Related Sections include but are not limited to the following

1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Divisions 02 through 49 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual specification sections to be reviewed at the time of Section submittals.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically-indexed file. Submit on digital media acceptable to Architect.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically-linked operation and maintenance directory.
b. Enable inserted reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Final Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

PART 2 - PRODUCTS

2.1 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

C. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

D. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

E. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Division 01 Section "Project Record Documents."

F. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

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SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. As-Built Record Drawings.
2. Record Specifications.
3. Record Product Data.

B. Related Sections:

1. Division 01 Section "Closeout Procedures" for general closeout procedures.
2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Divisions 02 through 49 Sections for specific requirements for project record documents of the Work in those Sections.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal: Submit 2 paper copies of marked-up record prints. Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
b. Final Submittal: Submit 2 paper copies and PDF electronic files of marked-up record prints. Print each Drawing, whether or not changes and additional information were recorded.

B. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

C. Submit all Documents to Construction Manager per their requirements

PART 2 - PRODUCTS

2.1 AS- BUILT RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Depths of foundations below first floor.
    d. Locations and depths of underground utilities.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities.
    j. Changes made by Change Order or Change Directive.
    k. Changes made following Architect's written orders.
    l. Details not on the original Contract Drawings.
    m. Field records for variable and concealed conditions.
    n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

B. Format: Submit record Specifications as annotated PDF electronic file.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

B. Format: Submit record Product Data as annotated PDF electronic file.

1. Include record Product Data directory organized by specification section number and title, electronically linked to each item of record Product Data.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and modifications to project record documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 01 78 39

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PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1.3 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

a. System, subsystem, and equipment descriptions.
b. Performance and design criteria if Contractor is delegated design responsibility.
c. Operating standards.
d. Regulatory requirements.
e. Equipment function.
f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:

a. Emergency manuals.
b. Operations manuals.
c. Maintenance manuals.
d. Project record documents.
e. Identification systems.
f. Warranties and bonds.
g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

a. Instructions on meaning of warnings, trouble indications, and error messages.
b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

END OF SECTION 01 79 00

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the selective demolition, removal, legal transport and disposal of exterior and interior construction indicated to be removed and/or demolished on the demolition drawings and to also include the following:

1. Existing electrical, fire alarm, mechanical, plumbing systems, devices and equipment as indicated on the demolition drawings.
2. Existing Exterior doors, glazed aluminum storefronts, existing exterior motor-operated O.H. Coiling Door.
3. Existing roofing systems:

    a. A majority of the existing metal roof deck at high roof area is to be demolished.
    b. Corroded/Deteriorated areas of metal roof deck as low roof area is to be selectively demolished.
    c. All existing roof system components including, but not limited to, roof membranes, flashings, roof membrane base flashings, insulation, ballasts, skylights and associated skylight curbs and roof equipment curbs.
    d. All existing metal copings and gravel stops are to be demolished and removed.

4. Select site elements indicate on the drawings

B. Related Sections include, but are not limited to, the following:

1. Section 01 10 00 “Summary” for additional information regarding Hazardous Materials.
2. Section 01 73 00 “Execution” for basic cutting and patching requirements.

1.2 DEFINITIONS

A. Non-Friable Asbestos Containing Material: Any material containing more than 1 percent asbestos as determined using the method specified in appendix E, subpart E, 40 CFR part 763, section 1, Polarized Light Microscopy that when dry, **cannot** be broken, crumbled, pulverized, or reduced to powder by hand pressure.

B. Friable Asbestos Containing Material: Any material containing more than 1 percent asbestos as determined using the method specified in appendix E, subpart E, 40 CFR part 763, section 1, Polarized Light Microscopy that, when dry, **can** be broken crumbled, pulverized, or reduced to powder by hand pressure.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.4 PREINSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection and for dust control. Indicate proposed locations and construction of barriers.

B. Schedule of selective demolition activities with starting and ending dates for each activity.

C. Predemolition photographs or video.

D. Contractor's Accredited Asbestos Consultant.

1.6 FIELD CONDITIONS

A. Owner will not occupy portions of the building.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials:

a. There are Asbestos Containing Materials (ACM) present in the existing building's exterior and interior construction and the General Contractor shall contract with a NC licensed asbestos abatement contractor to abate asbestos containing material and other hazardous materials **except the following ACM**:

1) Existing, exterior asbestos containing cement board panels which are to remain undisturbed and in a non-friable condition.

2) Existing asbestos containing sealant(s) at existing aluminum windows that are not indicated to be removed or altered and which are to remain undisturbed and in a non-friable condition.

b. Refer to Paragraph 3.4 herein.

c. Also refer to Section 01 10 00 "Summary" for additional information regarding Hazardous Materials.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations unless otherwise noted herein:

1. Provide commercial utility locator services with ground penetrating radar to locate natural gas and other utilities under area of existing concrete pavement to be demolished at area of new canopy. This is in addition to any utility location services needed for civil / landscaping work.

2. Existing natural gas piping and meter is within this area of demolition. Notify Owner to request gas shut down at street by Piedmont Natural Gas and schedule demolition work to be performed during non-occupied hours of building in an expeditious manner.

3. Other utilities such as may be located in this area

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Regulatory Requirements: Comply with governing Federal and State requirements regarding non-friable ACM materials to be left intact during the selective demolition process.

C. North Carolina Accredited Asbestos Design Consultant: Certificates and Credentials indicating consultant is currently in good standing with the State of North Carolina.

D. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated on the drawings to remain.and protect them against damage.

3.3 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

B. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION

A. Existing Hazardous Materials:

1. All Asbestos Containing Materials (ACM), with the exception of materials indicated in paragraph 3.4.A.2 herein, are to be removed and legally transported and disposed of by the General Contractor's licensed hazardous material abatement contractor.
   a. Hazardous Materials Abatement shall be performed at the beginning of the Project prior to any other work.
   b. All required permits and other documentation shall be the responsibility of the licensed hazardous material abatement contractor.

2. Asbestos Containing Materials (ACM) to remain :

   a. There are certain Asbestos Containing Materials (ACM) that will remain; the Owner has elected for them to remain intact.

   b. Contractor shall retain the services of a North Carolina Accredited Asbestos Design Consultant to develop a procedures program for Contractor to follow regarding executing the work in areas of existing Non-Friable Asbestos Containing Materials (ACM) that includes, but is not limited to, the following:

      1) Training of Workers in the identification any potential friable conditions of existing asbestos –containing cement board
      2) Training of Workers of any potential friable conditions of existing asbestos - based cement board.
      3) Appropriate Safety Requirements including required personnel protective clothing and apparatus.
      4) Test any additional areas of existing construction suspected of containing ACM.

   c. The existing exterior cement board panels are asbestos-containing cement board wall panels and soffit panels and must remain intact and in a non-friable state. There also additional areas of asbestos-containing cement board panels present at the roof side parapet walls which also must remain intact and in a non-friable state.

      1) Do not remove, saw, cut, drill or otherwise disturb these materials.
      2) When demolishing existing materials adjacent to the existing asbestos-containing cement board panels, extreme care must be taken:
         a) **If**, in the process of executing the work, there is any evidence that such work causes the existing asbestos-containing cement board panels to dust, crumble, chip, crack, crush, crumble or creates an friable condition of the existing asbestos-based cement siding boards, Contractor is to stop work and immediately notify Contractor's Asbestos Design Consultant, Owner and Architect.

   d. The existing aluminum windows have asbestos-containing sealants at perimeters with adjacent exiting construction and must remain intact and in a non-friable state.

3. The General Contractor's licensed hazardous material abatement contractor shall also remove, transport and legally dispose of any mercury containing thermostats, mercury containing fluorescent tubes, and the removal of lighting ballasts containing PCB's at the beginning of the Project prior to any other work.

B. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not demolish load bearing elements unless indicated on the structural drawings.
   a. Provide temporary shoring as required for enlargement of O.H. Coiling Door as necessary.

2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least 4 hours after flame-cutting operations.
6. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
7. Dispose of demolished items and materials promptly. Comply with requirements in Section 01 74 19 "Construction Waste Management and Disposal."

C. The complete removal of existing roof system(s) are specified in Section 07 01 50.19 “Preparation of Re-roofing”

1. Carefully remove existing Roof Copings in a manner that does not disturb the existing asbestos containing cement board panels or the existing treated wood nailer.
2. Notify Owner and Architect if the existing the existing treated wood nailer is in a deteriorated condition.

D. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

3.5 CLEANING

A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 01 74 19 "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

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

END OF SECTION 02 41 19

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SECTION 03 01 30.13 - MAINTENANCE OF EXISTING CONCRETE SLABS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Decreasing and cleaning of existing concrete slabs in the following areas:

   a. All areas project south of Column Line E.

2. Patching of existing drilled holes from removed floor mounted equipment in the following areas:

   a. All areas project south of Column Line E.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include material descriptions, chemical composition, physical properties, test data, and mixing, preparation, and application instructions.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.

PART 2 - PRODUCTS

2.1 CONCRETE CLEANER DEGREASER

A. Provide concentrated, non-acid based, commercial concrete cleaner degreaser by one of the following manufacturers
   a. PROSOCO, Inc: Cleaner/Degreaser All areas project south of Column Line E
   b. SureCrete: SCR Concrete Cleaner Degreaser Etcher
   c. Redi-Mix Colors (KreteTek Industries) Ghostshield: Micro Degreaser 1101

2.2 PATCHING MORTAR

A. Patching Mortar Requirements:

1. Color and Aggregate Texture: Provide patching mortar and aggregates of colors and sizes necessary to produce patching mortar that matches existing, adjacent, exposed concrete. Blend several aggregates if necessary to achieve suitable matches.

B. Provide Rapid Strengthening Cementitious Patching Mortar: Packaged, dry mix for repair of concrete by one of the following manufacturers:

1. Mapei: Planitop 18 ES
2. Euclid Chemical: VersaSpeed 100
3. Kaufman: Duracrete II FR

C. Compressive Strength: Not less than 3000 psi at 3-hours when tested according to ASTM C109/C109M.

PART 3 - EXECUTION

3.1 APPLYING CONCRETE CLEANER/ DEGREASER

A. Vacuum clean existing concrete floor slab.

B. Dilute concentrated cleaning degreasing solution per manufactures recommendations

C. Use pressurized spray equipment per manufacturer's written instructions.

D. Clean and degrease existing concrete floor slab, allowing solution to sit on substrate for manufacturer's recommended amount of time. Scrub heavily soiled areas with stiff bristle nylon brush. Flush thoroughly with water.

E. Repeat cleaning and degreasing process twice.

3.2 INSTALLATION OF PATCHING MORTAR

A. Pretreatment: Clean-out holes in existing concrete slab with metal tools and vacuum out holes debris. Apply bonding agent as recommended in writing by manufacturer.

B. General Placement: Place patching mortar by troweling toward edges of patch to force intimate contact with edge surfaces. For large patches, fill edges first and then work toward center, always troweling toward edges of patch.

C. Consolidation: After each lift is placed, consolidate material and screed surface.

D. Multiple Lifts: Where multiple lifts are used, score surface of lifts to provide a rough surface for placing subsequent lifts. Allow each lift to reach final set before placing subsequent lifts.

E. Finishing: Allow surfaces of lifts that are to remain exposed to become firm and then finish to a smooth surface with a wood or sponge float.

END OF SECTION 03 01 30

SECTION 03 10 00 – CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Form-facing material for cast-in-place concrete.

B. Related Requirements:

1. Section 321313 "Concrete Paving" for formwork related to concrete pavement and walks.

1.3 DEFINITIONS

A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.

B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review the following:

a. Special inspection and testing and inspecting agency procedures for field quality control.
b. Construction, movement, contraction, and isolation joints
c. Anchor rod and anchorage device installation tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each of the following:

1. Exposed surface form-facing material.
2. Concealed surface form-facing material.
3. Form ties.
4. Form-release agent.

B. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.

1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with ACI 301.

    a. Location of construction joints is subject to approval of the Architect.
3. Indicate form liner layout and form line termination details.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing and inspection agency.

B. Research Reports: For insulating concrete forms indicating compliance with International Code Council Acceptance Criteria AC353.

C. Field quality-control reports.

D. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Testing and Inspection Agency Qualifications: An independent agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Form Liners: Store form liners under cover to protect from sunlight.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

B. Design, engineer, erect, shore, brace, and maintain insulating concrete forms in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might

be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

1. Design cross ties to transfer the effects of the following loads to the cast-in-place concrete core:

    a. Wind Loads: As indicated on Drawings.

        1) Horizontal Deflection Limit: Not more than 1/240 of the wall height.

2.2 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:

1. Provide continuous, true, and smooth concrete surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:

    a. Plywood, metal, or other approved panel materials.
    b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

        1) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
        2) APA Plyform Class I, B-B or better; mill oiled and edge sealed.

B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.

1. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class.

1. Provide forms with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

2.3 RELATED MATERIALS

A. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

B. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

C. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
2. Form release agent for form liners shall be acceptable to form liner manufacturer.

D. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

A. Comply with ACI 301.

B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes.

C. Limit concrete surface irregularities as follows:

1. Surface Finish-1.0: ACI 117 Class D, 1 inch.
2. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.
3. Surface Finish-3.0: ACI 117 Class A, 1/8 inch.

D. Construct forms tight enough to prevent loss of concrete mortar.

1. Minimize joints.
2. Exposed Concrete: Symmetrically align joints in forms.

E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.

1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
3. Install keyways, reglets, recesses, and other accessories, for easy removal.

F. Do not use rust-stained, steel, form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.

1. Provide and secure units to support screed strips
2. Use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.

1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.

2. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer exterior corners and edges of permanently exposed concrete.

J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.

K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.

1. Determine sizes and locations from trades providing such items.
2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.

L. Construction and Movement Joints:

1. Construct joints true to line with faces perpendicular to surface plane of concrete.
2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
3. Place joints perpendicular to main reinforcement.
4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.

    a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls as indicated on Drawings.

    a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.

1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
5. Clean embedded items immediately prior to concrete placement.

3.3 REMOVING AND REUSING FORMS

A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work.

1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
2. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.

1. Align and secure joints to avoid offsets.
2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 FIELD QUALITY CONTROL

A. Inspections:

1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
2. Inspect insulating concrete forms for shape, location, and dimensions of the concrete member being formed.

END OF SECTION 03 10 00

SECTION 03 20 00 – CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review the following:
   a. Construction contraction and isolation joints.
   b. Steel-reinforcement installation.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Bar supports.
3. Mechanical splice couplers.

B. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1. Location of construction joints is subject to approval of the Architect.

1.5 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For the following, from a qualified testing agency:

1. Steel Reinforcement:

   a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.

2. Mechanical splice couplers.

B. Field quality-control reports.

C. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

B. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

C. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.

D. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

C. Mechanical Splice Couplers: ACI 318 Type 1, same material of reinforcing bar being spliced; tension-compression type.

D. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.

1. Finish: Plain.

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:

1. Do not cut or puncture vapor retarder.
2. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.

1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
2. Stagger splices in accordance with ACI 318.
3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.

4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.

G. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."

a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches.

2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

3.3 JOINTS

A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement.
2. Continue reinforcement across construction joints unless otherwise indicated.
3. Do not continue reinforcement through sides of strip placements of floors and slabs.

B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel-reinforcement placement.
2. Steel-reinforcement mechanical splice couplers.

END OF SECTION 03 20 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
3. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with fly ash.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete Subcontractor.

2. Review the following:

a. Special inspection and testing and inspecting agency procedures for field quality control.
b. Construction joints, control joints, isolation joints, and joint-filler strips.
c. Semirigid joint fillers.
d. Vapor-retarder installation.
e. Anchor rod and anchorage device installation tolerances.

f. Cold and hot weather concreting procedures.
g. Concrete finishes and finishing.
h. Curing procedures.
i. Forms and form-removal limitations.
j. Shoring and reshoring procedures.
k. Methods for achieving specified floor and slab flatness and levelness.
l. Floor and slab flatness and levelness measurements.
m. Concrete repair procedures.
n. Concrete protection.
o. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
p. Protection of field cured field test cylinders.

1.5 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Aggregates.
4. Admixtures:

    a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

5. Vapor retarders.
6. Floor and slab treatments.
7. Liquid floor treatments.
8. Curing materials.
9. Joint fillers.
10. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Calculated equilibrium unit weight, for lightweight concrete.
6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
10. Intended placement method.
11. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

    a. Location of construction joints is subject to approval of the Engineer of Record.

D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.
3. Testing agency: Include copies of applicable ACI certificates.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Floor and slab treatments.
5. Bonding agents.
6. Adhesives.
7. Vapor retarders.
8. Semirigid joint filler.
9. Joint-filler strips.
10. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Aggregates.

D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.

E. Research Reports:

1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder/termite barrier, showing compliance with ICC AC380.

F. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician.

1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Regional Materials: Concrete shall be manufactured within 100 miles of Project site from aggregates and cementitious materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.

B. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

C. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I/II, gray.
2. Fly Ash: ASTM C618, Class C or F.

D. Normal-Weight Aggregates: ASTM C33/C33M, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.

1. Alkali-Silica Reaction: Comply with one of the following:

a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.

2. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

E. Air-Entraining Admixture: ASTM C260/C260M.

F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

G. Water and Water Used to Make Ice: ASTM C94/C94M, potable.

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Barrier-Bac; Inteplast Group.

b. ISI Building Products.
c. Poly-America, L.P.
d. Reef Industries, Inc.
e. Stego Industries, LLC.
f. Tex-Trude.
g. W.R. Meadows, Inc.

2.4 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation.
b. ChemMasters, Inc.
c. ChemTec International.
d. Concrete Sealers USA.
e. Dayton Superior.
f. Euclid Chemical Company (The); an RPM company.
g. Kaufman Products, Inc.
h. Laticrete International, Inc.
i. Nox-Crete Products Group.
j. PROSOCO, Inc.
k. SpecChem, LLC.
l. US SPEC, Division of US MIX Company.
m. Vexcon Chemicals Inc.
n. V-Seal Concrete Sealers & Specialty Coatings.
o. W.R. Meadows, Inc.

2. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.5 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation.
b. Bon Tool Co.
c. ChemMasters, Inc.
d. Dayton Superior.
e. Euclid Chemical Company (The); an RPM company.
f. Kaufman Products, Inc.
g. Lambert Corporation.
h. Laticrete International, Inc.
i. Metalcrete Industries.

j. Nox-Crete Products Group.
k. Sika Corporation.
l. SpecChem, LLC.
m. TK Products.
n. Vexcon Chemicals Inc.
o. W.R. Meadows, Inc.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

1. Color:

a. Ambient Temperature Below 50 deg F: Black.
b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
c. Ambient Temperature Above 85 deg F: White.

C. Water: Potable or complying with ASTM C1602/C1602M.

D. Clear, Waterborne, Membrane-Forming, Non-dissipating Curing Compound: ASTM C309, Type 1, Class B, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anti-Hydro International, Inc.
b. BASF Corporation.
c. ChemMasters, Inc.
d. Dayton Superior.
e. Euclid Chemical Company (The); an RPM company.
f. Kaufman Products, Inc.
g. Lambert Corporation.
h. Laticrete International, Inc.
i. Metalcrete Industries.
j. Nox-Crete Products Group.
k. SpecChem, LLC.
l. TK Products.
m. Vexcon Chemicals Inc.
n. W.R. Meadows, Inc.

E. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ChemMasters, Inc.
b. Concrete Sealers USA.
c. Dayton Superior.
d. Euclid Chemical Company (The); an RPM company.
e. Kaufman Products, Inc.
f. Lambert Corporation.
g. Laticrete International, Inc.
h. Metalcrete Industries.
i. Nox-Crete Products Group.
j. Right Pointe.

k. SpecChem, LLC.
l. TK Products.
m. Vexcon Chemicals Inc.
n. W.R. Meadows, Inc.

2. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.6 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 in accordance with ASTM D2240.

C. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.7 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4,100 psi at 28 days when tested in accordance with ASTM C109/C109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5,000 psi at 28 days when tested in accordance with ASTM C109/C109M.

2.8 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for parking structure slabs, and concrete with a w/cm below 0.50.

2.9 CONCRETE MIXTURES

A. Class A: Normal-weight concrete used for footings, grade beams, and tie beams.

1. Exposure Class: ACI 318 F0, S0, W0, C0.
2. Minimum Compressive Strength: 3,000 psi at 28 days.
3. Maximum w/cm: 0.55.
4. Slump Limit: 4 inches, plus or minus 1 inch, before adding high-range water-reducing or plasticizing admixtures at the Project site (8 inches, plus or minus 1 inch thereafter).
5. Air Content: 2.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4 inch nominal maximum aggregate size.
6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

B. Class B: Normal-weight concrete used for foundation walls.

1. Exposure Class: ACI 318 F1, S0, W0, C0.
2. Minimum Compressive Strength: 4,500 psi at 28 days.
3. Maximum w/cm: 0.45.
4. Slump Limit: 4 inches, plus or minus 1 inch, before adding high-range water-reducing or plasticizing admixtures at the Project site (8 inches, plus or minus 1 inch thereafter).
5. Air Content:

    a. Exposure Class F1: 5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size.

6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

C. Class C: Normal-weight concrete used for interior slabs-on-ground.

1. Exposure Class: ACI 318 F0, S0, W0, C0.
2. Minimum Compressive Strength: 3,000 psi at 28 days.
3. Maximum w/cm: 0.55.
4. Minimum Cementitious Materials Content: 540 lb/cu. yd.
5. Slump Limit:4 inches, plus or minus 1 inch, before adding high-range water-reducing or plasticizing admixtures at the Project site (8 inches, plus or minus 1 inch thereafter).

6. Air Content: Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
7. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

D. Class F: Normal-weight concrete used for exterior slabs-on-ground, concrete toppings/pads over slabs-on-ground, exterior pads, and balcony topping slabs.

1. Exposure Class: ACI 318 F2, S0, W1, C0.
2. Minimum Compressive Strength: 4,500 psi at 28 days.
3. Maximum w/cm: 0.45.
4. Minimum Cementitious Materials Content: 540 lb/cu. yd.
5. Slump Limit: 4 inches, plus or minus 1 inch.
6. Air Content:

    a. Exposure Classes F2 and F3: 6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size.

7. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.4 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
4. Lap joints 6 inches and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.5 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by the Engineer of Record.
2. Place joints perpendicular to main reinforcement.

    a. Continue reinforcement across construction joints unless otherwise indicated.
    b. Do not continue reinforcement through sides of strip placements of floors and slabs.

3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls as indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.

7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Engineer of Record and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer of Record in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

    a. Do not use vibrators to transport concrete inside forms.
    b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
    c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.

    a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
    b. Remove projections larger than 1 inch.
    c. Tie holes do not require patching.
    d. Surface Tolerance: ACI 117 Class D.
    e. Apply to concrete surfaces not exposed to public view.

2. ACI 301 Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.

    a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
    b. Remove projections larger than 1/4 inch.
    c. Patch tie holes.
    d. Surface Tolerance: ACI 117 Class B.

e. Locations: Apply to concrete surfaces as indicated.

3. ACI 301 Surface Finish SF-3.0:

a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
b. Remove projections larger than 1/8 inch.
c. Patch tie holes.
d. Surface Tolerance: ACI 117 Class A.
e. Locations: Apply to concrete surfaces as indicated.

B. Rubbed Finish: Apply the following to as cast surface finishes where indicated on Drawings:

1. Smooth-Rubbed Finish:

a. Perform no later than one day after form removal.
b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.
d. Maintain required patterns or variances as shown on Drawings or to match field sample panels.

2. Grout-Cleaned Rubbed Finish:

a. Clean concrete surfaces after contiguous surfaces are completed and accessible.
b. Do not clean concrete surfaces as Work progresses.
c. Mix 1 part portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
d. Wet concrete surfaces.
e. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap, and keep surface damp by fog spray for at least 36 hours.
f. Maintain required patterns or variances as shown on Drawings or to match field sample panels.

3. Cork-Floated Finish:

a. Mix 1 part portland cement to 1 part fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint.
b. Mix 1 part portland cement and 1 part fine sand with sufficient water to produce a mixture of stiff grout. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
c. Wet concrete surfaces.
d. Compress grout into voids by grinding surface.
e. In a swirling motion, finish surface with a cork float.
f. Maintain required patterns or variances as shown on Drawings or to match field sample panels.

4. Scrubbed Finish: After concrete has achieved a compressive strength of from 1,000 to 1,500 psi, apply scrubbed finish.

a. Wet concrete surfaces thoroughly and scrub with stiff fiber or wire brushes, using water freely, until top mortar surface is removed and aggregate is uniformly exposed.
b. Rinse scrubbed surfaces with clean water.
c. Maintain continuity of finish on each surface or area of Work.
d. Remove only enough concrete mortar from surfaces to match field sample panels.

C. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish:

1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch in one direction.
3. Apply scratch finish to surfaces to receive concrete floor toppings and to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 (ACI A117M) tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:

a. Slabs on Ground:

1) Specified overall values of flatness, F_F 35; and of levelness, F_L 25; with minimum local values of flatness, F_F 24; and of levelness, F_L 17.

b. Suspended Slabs:

1) Specified overall values of flatness, F_F 35; and of levelness, F_L 20; with minimum local values of flatness, F_F 24; and of levelness, F_L 15. Levelness requirements may be waived for slabs on metal deck.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with Architect before application.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 4 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: As indicated herein.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.

a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

b. Cast anchor-bolt insert into bases.
c. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.

1. Cast-in inserts and accessories, as shown on Drawings.
2. Reinforce interior stairs that use concrete fill for the landings and/or treads with either microsynthetic monofilament fibers (at a minimum dosage rate of 1.0 lbs/cy) or 4x4-W1.4xW1.4 welded wire fabric.
3. Screed, tamp, and trowel finish concrete surfaces.

3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305.1, before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. If forms remain during curing period, moist cure after loosening forms.
3. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:

a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
b. Continuous Sprinkling: Maintain concrete surface continuously wet.
c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

1) Recoat areas subject to heavy rainfall within three hours after initial application.
2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:

a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

   a) Lap edges and ends of absorptive cover not less than 12-inches.
   b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

   a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
   b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

   a) Water.
   b) Continuous water-fog spray.

b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

   a) Lap edges and ends of absorptive cover not less than 12 inches.
   b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

   a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
   b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

   a) Water.
   b) Continuous water-fog spray.

c. Floors to Receive Polished Finish: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

a) Lap edges and ends of absorptive cover not less than 12 inches.
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

d. Floors to Receive Curing Compound:

1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Maintain continuity of coating, and repair damage during curing period.
4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

e. Floors to Receive Curing and Sealing Compound:

1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Repeat process 24 hours later and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.11 TOLERANCES

A. Conform to ACI 117.

3.12 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than seven days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
4. Rinse with water; remove excess material until surface is dry.
5. Apply a second coat in a similar manner if surface is rough or porous.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month.
2. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas when approved by Architect.
2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.

    a. Limit cut depth to 3/4 inch.
    b. Make edges of cuts perpendicular to concrete surface.
    c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
    d. Fill and compact with patching mortar before bonding agent has dried.
    e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.

    a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
    b. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.

a. Correct low and high areas.
b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.

a. Finish repaired areas to blend into adjacent concrete.

5. Correct other low areas scheduled to remain exposed with repair topping.

a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.

a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
d. Place, compact, and finish to blend with adjacent finished concrete.
e. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.

a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
b. Dampen cleaned concrete surfaces and apply bonding agent.
c. Place patching mortar before bonding agent has dried.
d. Compact patching mortar and finish to match adjacent concrete.
e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

    a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

        1) Project name.
        2) Name of testing agency.
        3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
        4) Name of concrete manufacturer.
        5) Date and time of inspection, sampling, and field testing.
        6) Date and time of concrete placement.
        7) Location in Work of concrete represented by samples.
        8) Date and time sample was obtained.
        9) Truck and batch ticket numbers.
        10) Design compressive strength at 28 days.
        11) Concrete mixture designation, proportions, and materials.
        12) Field test results.
        13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
        14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:

a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
b. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; ASTM C173/C173M volumetric method, for structural lightweight concrete.

   a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C1064/C1064M:

   a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

5. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.

   a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

6. Compression Test Specimens: ASTM C31/C31M:

   a. Cast and laboratory cure two sets of four 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C39/C39M.

   a. Test one set of two laboratory-cured specimens at seven days and three sets of two specimens at 28 days.
   b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5,000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5,000 psi.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests:

    a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed byEngineer of Record.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed byEngineer of Record.

1) Acceptance criteria for concrete strength shall be in accordance with ACI 301, section 1.6.6.3.

12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 24 hours of completion of floor finishing and promptly report test results to Architect.

3.16 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 03 30 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete Staining

B. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for new concrete

1.2 DEFINITIONS

A. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of polished concrete.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review concrete finishing procedures

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product requiring color selection.

C. Samples for Verification: For each type of exposed color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Stain materials.

1.6 QUALITY ASSURANCE

A. Mockups: Provide in-place mockup to verify selections made under Sample submittals and to demonstrate surface finish, tolerances, and standard of workmanship.

1. Build mockup at an area where mockup will be covered by millwork at a location of new and existing concrete.

1.7 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 STAIN MATERIALS (STC-1 and STC-2)

A. Penetrating Stain: Water-based, penetrating stain with colorfast pigments.

1. Subject to compliance with the requirements provide COLORTOP, a water-based. solid color concrete stain as manufactured by H&C or a comparable product by one of the following:

   a. NewLook International; EnduraStain Solid Color
   b. Or an approved equal.

2. Stain Colors:

   a. STC-1: Provide solid color stain as selected by Architect from one of manufacturer's minimum offering of 40 standard colors.
   b. STC-2: Provide custom tinted solid color stain equal to Sherwin William's Color 6685 "Trinket".

PART 3 - EXECUTION

3.1 STAINING

A. Newly placed concrete to be at least 30 days old before staining.

B. Prepare surfaces according to manufacturer's written instructions and as follows:

1. Clean concrete thoroughly by scraping, applying solvents or stripping agents, sweeping and pressure washing, or scrubbing with a rotary floor machine and detergents recommended by stain manufacturer. Rinse until water is clear and allow surface to dry.
2. Test existing and new concrete surfaces with droplets of water. If water beads and does not penetrate surface, or penetrates only in some areas, profile surfaces by grinding, sanding, or abrasive shot blasting. Retest and continue profiling surface until water droplets immediately darken and uniformly penetrate concrete surfaces.
3. Neutralize concrete surfaces and rinse until water is clear. Test surface for residue with clean white cloth. Test surface according to ASTM F710 to ensure pH is between 7 and 8.

C. Allow concrete surface to dry before applying stain. Verify readiness of concrete to receive stain according to ASTM D4263 by tightly taping 18-by-18-inch, 4-mil-thick polyethylene sheet to a

representative area of concrete surface. Apply stain only if no evidence of moisture has accumulated under sheet after 16 hours.

D. Penetrating Stain: Apply penetrating stain to concrete surfaces according to manufacturer's written instructions and as follows:

1. Apply first coat of stain to dry, clean surfaces by airless sprayer or by high-volume, low-pressure sprayer.
2. Allow to dry four hours and repeat application of stain in sufficient quantity to obtain color consistent with approved mockup.
3. Rinse until water is clear. Control, collect, and legally dispose of runoff.

END OF SECTION 03 35 43

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SECTION 03 53 00.13 POLISHED DECORATIVE CONCRETE TOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, general provisions of the Contract, and other related construction documents such as Division 01 specifications apply to this Section

1.2 SUMMARY

A. This section includes Decorative Concrete Topping System provided under a lump sum allowance. The Owner and Architect will decide if the existing concrete slab conditions, once uncovered by will require Decorative Concrete Topping System at the following specific areas:

1.

B. Related Sections include the following:

1. Section 01 21 00, “Allowances”

1.3 REFERENCES

A. ASTM C109M, Compressive Strength Air-Cure Only

B. ASTM C348, Flexural Strength of Hydraulic-Cement Mortar

C. ASTM F2170, Relative Humidity in Concrete Floor Slabs Using in situ Probes

D. ASTM F710, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

E. ASTM E430, Standard Test Method for Measurement of Gloss of High-Gloss Surfaces by Abridged Goniophotometry

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s product data and installation instructions for each material and product used. Include manufacturer’s Safety Data Sheets.

B. Qualification Data: Provide written documentation from the manufacturer confirming that installer meets the qualifications as specified and is eligible for manufacturer’s warranty. Provide project names, address, contact names, phone numbers of projects of similar scope completed by the installer.

C. Maintenance Data: Provide instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under intended use. These instructions should contain precautions against cleaning products and methods that may be detrimental to finishes and performance.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer must be experienced in performing specified work similar in design, products and scope of this project, with a documented track record of successful, in-service performance and with sufficient production capabilities, facilities and personnel to produce specified work.

B. Pre-Installation Conference:

1. Prior to the installation of the decorative concrete topping system an on-site conference shall be conducted to review specification requirements.
2. The minimum agenda shall include a review of the site conditions, construction documents, schedule, installation procedures, protection procedures and submittals.
3. Single source responsibility: Provide all topping mixtures, primers, pigments and accessories by one manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in original containers, bearing manufacturer's labels indicating brand name and directions for storage, factory numbered and sealed until ready for installation.

B. Store all materials in a dry, climate-controlled environment at a minimum of 50°F (10°C) and maximum of 85°F (29°C).

C. Handle products in accordance with manufacturer's printed recommendations.

1.7 SITE CONDITIONS

A. Do not install below 50°F (10°C) or above 85°F (29°C) surface temperature. Install quickly if floor is warm (above 70°F/21°C and up to 85°F/29°C) and follow warm weather precautions available from the manufacture.

B. Inspect the existing substrate and document unsatisfactory conditions in writing. Verify that surfaces and site conditions are ready to receive work. Correct unacceptable conditions prior to installation of System. Commencement of work constitutes acceptance of substrate conditions.

C. Close areas to traffic during and after the installation.

1.8 WARRANTY

A. Products: Provide Manufacturer's 1- year warranty against manufacturing defects.

B. Installers Warranty: Provide Installer's 2-year Warranty against faulty installation and workmanship.

PART 2 – PRODUCTS

2.1 DECORATIVE CONCRETE TOPPING SYSTEM (PC-1)

A. Portland Cement-based Self-Leveling Topping are suitable to receive a mechanical polish concrete process.

B. Manufacturers: Subject to Compliance with the requirements provide ARDEX K530 Decorative Topping System with white base Color or an equivalent product systems by one of the following:

1. CTA Cement; TRU PC with white base color
2. Mapei Corporation: Ultratop with white base color.
3. Or an approved equal.

C. Performance and Physical Properties:

1. Performance and Physical Properties:

a. Meet or exceed the following values for material cured at 70°F (20°C) and 50% relative humidity.
b. Flow Time: 10 minutes.
c. Compressive Strength: 6,000 psi (420 kg/cm^2) at 28 days.
d. ASTM C109M Flexural Strength: 1,200 psi (84 kg/cm^2) at 28 days.
e. VOC: 0

2. Integral color:

a. Provide Liquid or Powder pigments can be utilized for integral pigmentation. The pigments must be suitable for use with the topping cementitious product.
b. Color to be selected by Architect from manufacturers' standard colors

2.2 CONCRETE POLISH EQUIPMENT & TOOLING

A. Equipment and Tooling for use as part of the multi-step dry mechanical process and accessories. Acceptable products include:

1. Planetary Grinder and Polisher

a. Features: Large Platform: planetary floor polisher.
b. Tooling
   i. Metal Bonded Diamonds 40 - 150 Grit of bonded metal
   ii. Transitional Diamonds Ceramic
   iii. Resin Bonded Diamonds - 200, 400, 800, 1500 Grit, as needed

2. Micro Polisher – Burnishers

a. Specific weight and RPM are required for application of floor finish/guard
b. Required Tooling: Diamond Impregnated Pads – 400, 800, 1500, 3000 Grit

3. Other equipment and tooling as necessary for small areas and edge work.

4. All grinding and polishing completed with grinder/polisher equipment should be connected to a dust collector.

2.3 CONCRETE TREATMENT CHEMICALS

A. Concrete treatments designed for use in conjunction with the installation of the Polished Concrete Topping.

2.4 CRACK AND JOINT REPAIR

A. Low Viscosity Rigid Polyurethane Crack and Joint Repair.

2.5 STAIN AND WEAR PROTECTION

A. Concrete stain and wear protection designed for used in conjunction with the installation of Polished Decorative Concrete System. Products should be selected to protect the surface based on the long-term use and wear of the surface.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all concrete substrates and conditions under which the Polished Decorative Concrete Topping is to be installed.

B. Verify that existing concrete has cured a minimum of 28 days before installing Concrete Toppings and meets the strength requirement of a minimum compressive strength of 3000 psi, a minimum density of 100 pcf and a minimum tensile strength of 200 psi.

C. Conduct pre-installation conference, per Section 1.5 C.

3.2 PREPARATION

A. All concrete subfloors must be sound, solid, clean, and free of all oil, grease, dirt, curing compounds and any substance that might act as a bond breaker before priming. Mechanically clean if necessary. Acid etching and the use of sweeping compounds and solvents are not acceptable.

B. Concrete shall be mechanically prepared to achieve a concrete surface profile (CSP) 3 in accordance with ICRI standards

C. Substrates shall be inspected for moisture or any other conditions that could affect the performance of the decorative concrete topping system. Moisture vapor emissions shall not exceed 85% RH, ASTM F 2170. For areas where moisture vapor emissions exceed the specified limits, install the appropriate Moisture Control System as manufacture by the decorative concrete topping manufacturer.

D. Joint Preparation: Honor all moving cracks and all joints, including expansion joints, isolation joints and control joints (saw cuts), up through the decorative concrete topping.

1. All non-moving cracks shall be filled with manufacturer’s low viscosity rigid Polyurethane Crack & Joint Repair.

E. Dormant Cracks: Before proceeding with the installation, all dormant cracks greater than 1/32" wide must be prefilled with a fully rigid, high-modulus, 100% solids material.

3.3 APPLICATION OF DECORATIVE CONCRETE TOPPING

A. PRIMING

1. Primed the prepared concrete with manufacturer's epoxy-based primer. Follow manufacturer's installation instructions.

2. If the Moisture Control System is used, the sand-broadcast surface of the Moisture Control System may serve as the primer if allowable by manufacturer.

B. MIX DESIGNS

1. Mixing Ratio: The ARDEX Topping shall be mixed in 2-bag batches. Mix each bag of the powder with the specified amount of water in an ARDEX T-10 Mixing Drum using an ARDEX T-1 Mixing Paddle and a 1/2" heavy-duty drill (12 mm, min. 650 rpm). Mix thoroughly for 2-3 minutes to obtain a lump-free mixture. Follow written instructions on the ARDEX product Technical Data Sheet or bag label.

2. Decorative Aggregate mix: For decorative applications approved decorative aggregates may be added to ARDEX K530 up to 1:1 by weight. Aggregates must conform to ASTM C33/C33M.

   a. Broadcast Aggregate: Quartz, Granite, Marble, Limestone, River Gravel; Angular / Smooth / Flat; Size 00 up to 3/8"; Clean / Washed / Dry – Dust Free

   b. Pre-Consumer Glass (colored) or Mirror with a non-reactive coating; Angular, Smooth, Flat; Size 00 up to 3/8"; Clean / Washed / Dry – Dust Free

   c. Aggregate Color: Natural colors only, no dyed or color enhanced aggregates

   d. Organic Compounds / Metal / Iron / Post-Consumer Recycled Glass – Not permitted

3. Aggregates from a single source with a documented satisfactory service record for at least 10 years in similar applications and service conditions using similar aggregates and cementitious materials. When using decorative aggregates the minimum depth of the application shall be 3/8" (9.5mm) or 3x that of the largest aggregate in the mix. Do not use sand.

C. INSTALLATION

1. The minimum installation thickness for Topping shall be 3/8". The necessary thickness will vary with jobsite conditions and must be adequate to achieve the desired finish.

2. Pour or pump the liquid topping and spread in place with the spreader. Use Smoother for featheredge and touch-up. Wear baseball shoes with non-metallic cleats to avoid leaving marks in the liquid topping. The topping can be walked on in 2-3 hours at 70°F (21°C).

3. Allow the Topping to cure a minimum of 24 hours before proceeding with the polishing process. Drying time is a function of jobsite temperature and humidity conditions, as well

as the installation thickness.

3.4 POLISHING PROCESS FOR ARDEX TOPPING

A. Processing of the Polished Decorative Concrete Topping includes concrete preparation, joint treatment and chemicals to achieve the intended result.

1. Processing:

   a. Grind/Polish #1: 40 - 150 Grit Soft-Medium Metal Bonded Diamonds. Vacuum floor after each grinding/polishing step to remove dust.
   b. Grind/Polish #2: #50 - 200 Grit Transitional, Ceramic / Flat block resin bonded diamonds. Vacuum floor after each grinding/polishing step to remove dust.
   c. Grind/Honing #3: 100 - 200 grit Resin Bonded Diamond. Vacuum floor after each grinding/polishing step to remove dust.
   d. Apply densifier per Manufactures instructions.
   e. Grind/Polishing #4: 400 grit Resin Bonded Diamond. Vacuum floor after each grinding/polishing step to remove dust.
   f. Grind/Polishing #4: 400 or 800 grit Resin Bonded Diamond. Vacuum floor after each grinding/polishing step to remove dust. Use 800 grit when higher gloss level is desired. Proceed with successively higher grits until gloss level desired.
   g. Apply finish/guard per application instructions and allow to dry a minimum of 30-60 minutes.
   h. Micropolish/Burnish Use 800 – 1500 grit pad. Dry, micro fiber mop the floor clean to remove all debris. Floor should be allowed to cool to room temperature prior to second application.
   i. Apply finish/guard per application instructions allow to dry a minimum of 1hour.
   j. Micropolish/Burnish Use 1500-3000 grit pad. Dry mop the floor clean to remove all debris.

   k. Apply a protective sealer that is appropriate for the intended use and wear of the surface. Allow the sealer to cure per the manufactures recommendation before opening it up to traffic.

2. Edgework - Polished edge work of topping shall be done with a handheld or walk behind polishing tool. The edge polishing process will match the corresponding steps outlined above for the desired gloss level.

3.5 POST INSTALLATION

1. All moving cracks and joints shall be filled with a flexible sealing compound specifically designed for use in moving joints.

3.6 PROTECTION

A. Protect the new Topping from spills and contamination by petroleum, oil, hydraulic fluid, acid and acidic detergents, paint and other liquid dripping from trades and equipment working over these substrates. If construction equipment must be used on these substrates, diaper all components that may drip fluids. Protect surface by installing a Protective Floor Covering.

B. Avoid moisture for 72 hours after installation. Don’t permit standing water for this period or place any protective plastic sheeting, rubber matting, rugs or furniture that can prevent proper

drying, thereby trapping moisture, which can result in a cloudy effect on the floor.

C. For 48 hours after application: Avoid moisture, standing water, deep cleaning and covering with protective plastic sheeting, mats, rugs or furniture, which may inhibit proper curing. Light pedestrian use may occur after 3 hours. Maximum performance develops in about 72 hours.

3.7 MAINTENANCE

A. Specific maintenance recommendations shall be provided by the installer performing the work of this section.

B. Provide a scheduled maintenance visit within 2 Months after the Certificate of Completion. Provide a regular cleaning in accordance the Maintenance/Post Cleaning procedure, accompanied by Micro Polishing.

END OF SECTION 03 53 00.13

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SECTION 03 54 16 - HYDRAULIC CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes hydraulic-cement-based, polymer-modified, self-leveling underlayment for application below interior floor coverings.

1.3 ALLOWANCES

A. Furnish and install hydraulic-cement-based underlayment as part of underlayment allowance.

1.4 UNIT PRICES

A. Work of this Section is affected by underlayment unit price.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: Signed by manufacturers of underlayment and floor-covering systems certifying that products are compatible.

C. Minutes of pre-installation conference.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

B. Product Compatibility: Manufacturers of underlayment and floor-covering systems certify in writing that products are compatible.

C. Pre-installation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.

1. Place hydraulic-cement-based underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F.

1.10 COORDINATION

A. Coordinate application of underlayment with requirements of floor-covering products and adhesives, to ensure compatibility of products.

PART 2 - PRODUCTS

2.1 HYDRAULIC-CEMENT-BASED UNDERLAYMENTS

A. Underlayment: Hydraulic-cement-based, polymer-modified, self-leveling product that can be applied in minimum uniform thickness of 1/4 inch and that can be feathered at edges to match adjacent floor elevations.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Ardex; K-15 Self-Leveling Underlayment Concrete.
b. Bonsal American, an Oldcastle company; ProSpec Level Set 300
c. Dayton Superior Corporation; LeveLayer.

2. Cement Binder: ASTM C 150, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
3. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C 109/C 109M.
4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.

B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch; or coarse sand as recommended by underlayment manufacturer.

1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.

C. Water: Potable and at a temperature of not more than 70 deg F.

D. Reinforcement: For underlayment applied to wood substrates, provide galvanized metal lath or other corrosion-resistant reinforcement recommended in writing by underlayment manufacturer.

E. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

1. Primer shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D.
2. Primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance.

1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prepare and clean substrate according to manufacturer's written instructions.

1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
2. Fill substrate voids to prevent underlayment from leaking.

B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.

1. Moisture Testing: Contractor will perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

C. Metal Substrates: Mechanically remove, according to manufacturer's written instructions, rust, foreign matter, and other contaminants that might impair underlayment bond. Apply corrosion-resistant coating compatible with underlayment if recommended in writing by underlayment manufacturer.

D. Nonporous Substrates: For ceramic tile, quarry tile, and terrazzo substrates, remove waxes, sealants, and other contaminants that might impair underlayment bond, and prepare surfaces according to manufacturer's written instructions.

E. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.3 APPLICATION

A. General: Mix and apply underlayment components according to manufacturer's written instructions.

1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
2. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.
3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Apply underlayment to produce uniform, level surface.

1. Apply a final layer without aggregate to product surface.
2. Feather edges to match adjacent floor elevations.

D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

F. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 PROTECTION

A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 03 54 16

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Structural steel.
2. Shrinkage-resistant grout.

B. Related Requirements:

1. Section 051213 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
2. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.
3. Section 055000 "Metal Fabrications" for miscellaneous steel fabrications and other steel items not defined as structural steel.
4. Section 099600 "High-Performance Coatings" for painting requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303 “Code of Standard Practice for Steel Buildings and Bridges”.

1.4 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Shear stud connectors.
4. Anchor rods.
5. Threaded rods.
6. Shop primer.
7. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.

C. Delegated-Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Fabricator, see either 1.8.A.1 or 1.8.A.2 for informational submittals needed to satisfy qualification requirements.
2. For Erector, see either 1.8.B.1 or 1.8.B.2 for informational submittals needed to satisfy qualification requirements.

B. Welding certificates, as used by either the Fabricator or the Erector.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural-steel materials, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shear stud connectors.

1.8 QUALITY CONTROL

A. Fabricator Qualifications: The Fabricator must meet at least one of the two following requirements.

1. A Fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection

Program for Structural Steel (Accreditation Criteria 172). The Fabricator shall also have a minimum of 5 years of experience in fabricating structural steel like that indicated for this project (with a record of successful service performance) and sufficient capacity to fabricate the structural steel without delaying the work. Qualification requirements shall be satisfied by submittal of the following:

a. Completed project history for Fabricator, specifically focused on projects whose structural steel is like that for this project. Project history shall include Owner and Structural Engineer (as well as primary contacts) for each project listed. This qualification requirement shall be submitted as part of the bidding process.
b. Current AISC or IAS certification documents.

2. A Fabricator that has an established and maintained quality control program to ensure that the work is performed in accordance with the requirements in ANSI/AISC 303 “Code of Standard Practice for Steel Buildings and Bridges”, ANSI/AISC 360 “Specification for Structural Steel Buildings”, and the Contract Documents. Program shall at a minimum address inspection of the items noted in ANSI/AISC 360 N2. The Fabricator shall also have a minimum of 5 years of experience in fabricating structural steel like that indicated for this project (with a record of successful service performance) and sufficient capacity to fabricate the structural steel without delaying the work. Qualification requirements shall be satisfied by submittal of the following:

a. Completed project history for Fabricator, specifically focused on projects whose structural steel is like that for this project. Project history shall include Owner and Structural Engineer (as well as primary contacts) for each project listed. This qualification requirement shall be submitted as part of the bidding process.
b. A written quality control manual that shall include (at a minimum) procedures for material control, inspection, and non-conformances.
c. Quality Control Inspector (QCI) qualifications.

B. Erector Qualifications: The Erector must meet at least one of the two following requirements.

1. An Erector who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE. The Erector shall also have a minimum of 5 years of experience in erecting structural steel like that indicated for this project (with a record of successful service performance) and sufficient capacity to erect the structural steel without delaying the work. Qualification requirements shall be satisfied by submittal of the following:

a. Completed project history for Erector, specifically focused on projects whose structural steel is like that for this project. Project history shall include Owner and Structural Engineer (as well as primary contacts) for each project listed. This qualification requirement shall be submitted as part of the bidding process.
b. Current AISC certification documents.

2. An Erector that has an established and maintained quality control program to ensure that the work is performed in accordance with the requirements in ANSI/AISC 303 “Code of Standard Practice for Steel Buildings and Bridges”, ANSI/AISC 360 “Specification for Structural Steel Buildings”, and the Contract Documents. Program shall at a minimum address inspection of the items noted in ANSI/AISC 360 N2. The Erector shall also have a minimum of 5 years of experience in erecting structural steel like that indicated for this project (with a record of successful service performance) and sufficient capacity to erect the structural steel without delaying the work. Qualification requirements shall be satisfied by submittal of the following:

a. Completed project history for Erector, specifically focused on projects whose structural steel is like that for this project. Project history shall include Owner and Structural Engineer (as well as primary contacts) for each project listed. This qualification requirement shall be submitted as part of the bidding process.
b. A written quality control manual that shall include (at a minimum) procedures for material control, inspection, and non-conformances.
c. Quality Control Inspector (QCI) qualifications.

C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:

1. ANSI/AISC 303 “Code of Standard Practice for Steel Buildings and Bridges”.
2. ANSI/AISC 360 “Specification for Structural Steel Buildings”.
3. RCSC's "Specification for Structural Joints Using High-Strength Bolts".

B. Connection Design Information:

1. Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.

a. Use Load and Resistance Factor Design; data are given at factored-load level.

C. Moment Connections: Type PR, partially restrained.

D. Construction: As indicated.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M.

B. Channels, Angles: ASTM A36/A36M.

C. Plate and Bar: ASTM A36/A36M, and ASTM A572/A572M, Grade 50 as indicated.

D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade B structural tubing.

E. Steel Pipe: ASTM A500/A500M, Grade B.

1. Weight Class: Standard, or as indicated.
2. Finish: Black except where indicated to be galvanized.

F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

C. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

2.4 RODS

A. Unheaded Anchor Rods: ASTM F1554, Grade 36, or Grades 55 and 105 as indicated on the Drawings.

1. Configuration: Straight.
2. Nuts: ASTM A563 heavy-hex carbon steel.
3. Plate Washers: ASTM A36/A36M carbon steel.
4. Washers: ASTM F436, Type 1, hardened carbon steel.
5. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.

B. Headed Anchor Rods: ASTM F1554, Grade 36, or Grades 55 and 105 as indicated on the Drawings.

1. Configuration: Straight.
2. Nuts: ASTM A563 heavy-hex carbon steel.
3. Plate Washers: ASTM A36/A36M carbon steel.
4. Washers: ASTM F436, Type 1, hardened carbon steel.
5. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.

C. Threaded Rods: ASTM A36/A36M.

1. Nuts: ASTM A 63 heavy-hex carbon steel.
2. Washers: ASTM F436, Type 1, hardened carbon steel.
3. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.

2.5 PRIMER

A. Steel Primer:

1. Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanized-Steel Primer: MPI#134.

1. Etching Cleaner: MPI#25, for galvanized steel.
2. Galvanizing Repair Paint: ASTM A780/A780M.

2.6 SHRINKAGE-RESISTANT GROUT

A. Non-metallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, non-metallic aggregate grout, non-corrosive and non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 1.

F. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.

H. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

I. Inspection Requirements: Quality control inspection tasks shall be performed by the Fabricator's QCI in accordance with ANSI/AISC 360 N5.4 (Inspection of Welding), N5.6 (Inspection of High-Strength Bolting), and N5.7 (Inspection of Galvanized Structural Steel Main Members). Tasks in Tables N5.4-1 through N5.4-3 and Tables N5.6-1 through N5.6-3 listed for quality control (QC) are those inspections performed by the QCI(s) to ensure that the work is performed in accordance with the Contract Documents.

1. Non-destructive testing (NDT) of welded joints provided during fabrication shall be performed by either an independent and qualified testing agency or the qualified QCI(s). All testing reports shall be submitted to the Owner for review.

a. Conduct NDT of all welded joints primarily supporting gravity loads (i.e. cantilevers). Reduction in the rate of NDT per N5.5e is prohibited.
b. For Risk Category II structures, conduct NDT of 10% of remaining CJP groove welds for materials 5/16" thick and greater per ANSI/AISC 360 N5.5b.
c. For Risk Category III and IV structures, conduct NDT of all remaining CJP groove welds for materials 5/16" thick and greater per ANSI/AISC 360 N5.5b.
d. Conduct NDT of all welded joints subject to fatigue, where required by ANSI/AISC 360 Appendix 3, Table A-3.1. Reduction in the rate of NDT per N5.5e is prohibited.

J. At the completion of fabrication, the Fabricator shall submit a certificate of compliance to the Owner stating that the materials supplied and work performed by the Fabricator are in accordance with the Contract Documents. All testing/inspection reports generated as part of 2.7.I or 2.7.J shall also be submitted for review at the completion of fabrication.

2.8 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize items as indicated on the Drawings.

2.10 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

1. SSPC-SP 2.
2. SSPC-SP 3.

C. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in

intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Base Plates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Inspection Requirements: Quality control inspection tasks shall be performed by the Erector’s QCI in accordance with ANSI/AISC 360 N5.4 (Inspection of Welding), N5.6 (Inspection of High-Strength Bolting), and N5.7 (Inspection of Galvanized Structural Steel Main Members). Tasks in Tables N5.4-1 through N5.4-3 and Tables N5.6-1 through N5.6-3 listed for quality control (QC) are those inspections performed by the QCI(s) to ensure that the work is performed in accordance with the Contract Documents.

1. Non-destructive testing (NDT) of welded joints provided during erection shall be performed by an independent and qualified testing agency (see 3.3.J). All testing reports shall be submitted to the Owner for review.

a. Conduct NDT of all welded joints primarily supporting gravity loads (i.e. cantilevers). Reduction in the rate of NDT per N5.5e is prohibited.
b. For Risk Category II structures, conduct NDT of 10% of remaining CJP groove welds for materials 5/16" thick and greater per ANSI/AISC 360 N5.5b.
c. For Risk Category III and IV structures, conduct NDT of all remaining CJP groove welds for materials 5/16" thick and greater per ANSI/AISC 360 N5.5b.
d. Conduct NDT of all welded joints subject to fatigue, where required by ANSI/AISC 360 Appendix 3, Table A-3.1. Reduction in the rate of NDT per N5.5e is prohibited.

I. Special Inspections: Where special inspections are required by the Contract Documents, the Owner will engage a Special Inspector to perform the tasks noted in the Statement of Special Inspections during erection. These inspections shall be considered to satisfy the quality assurance requirements of ANSI/AISC 360 Chapter N.

J. Testing Agency: The Owner will engage an independent and qualified testing agency to perform tests and inspections.

1. Bolted Connections: Inspect and test bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts".
2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M. Non-destructive testing (NDT) methods (as required) are as follows:

a. Liquid Penetrant Inspection: ASTM E165/E165M.
b. Magnetic Particle Inspection: ASTM E709, performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not acceptable.
c. Ultrasonic Inspection: ASTM E164.
d. Radiographic Inspection: ASTM E94/E94M.

K. At the completion of erection, the approved Erector shall submit a certificate of compliance to the Owner stating that the materials supplied and work performed by the Erector are in accordance with the Contract Documents.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

3.5 PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

END OF SECTION 05 12 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Roof deck.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for normal-weight.
2. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Power-actuated mechanical fasteners.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

C. Recycled Content of Steel Products: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

2.2 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Canam Steel Corporation; Canam Group, Inc.
2. Cordeck.
3. DACS, Inc.
4. Epic Metals Corporation.
5. Marlyn Steel Decks, Inc.
6. New Millennium Building Systems, LLC.
7. Nucor Corp.
8. Roof Deck, Inc.
9. Valley Joist.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33, G60 zinc coating.
2. Deck Profile: As indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: As indicated.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0747 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

J. Galvanizing Repair Paint: ASTM A780/A780M.

K. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF DECK INSTALLATION

A. Fasten roof deck panels to steel supporting members as indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum or butted at Contractor's option.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.

E. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof deck panels unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. Prepare test and inspection reports.

3.5 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

END OF SECTION 05 31 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Steel framing and supports for operable partitions.
2. Steel framing and supports for countertops.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Steel Rung Ladders.
6. Interior Metal bollards and Bollard Covers
7. Loose bearing and leveling plates for applications where they are not specified in other Sections.
8. Slotted Channel Framing for support of suspended ceiling systems and other systems requiring overhead support.

B. Products furnished, but not installed, under this Section:

1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.3 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections to structure. Show anchorage and accessory items.

1.5 INFORMATIONAL SUBMITTALS

A. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Research Reports: For post-installed anchors.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

D. Steel Tubing: ASTM A 500, cold-formed steel tubing.

E. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

F. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: Minimum 1-5/8 by 1-5/8 inches and as indicated.
2. Material: Cold-rolled steel, ASTM A 1008/A 1008M, structural steel, Grade 33; 0.0966-inch minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless-steel fasteners for fastening stainless steel.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.

D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Eyebolts: ASTM A 489.

F. Machine Screws: ASME B18.6.3.

G. Wood Screws: Flat head, ASME B18.6.1.

H. Plain Washers: Round, ASME B18.22.1.

I. Lock Washers: Helical, spring type, ASME B18.21.1.

J. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

K. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

L. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts,

complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 09 painting Sections.

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

G. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

I. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form exposed work with accurate angles and surfaces and straight edges.

D. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.

E. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

F. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

G. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

H. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

I. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inchembedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

2.7 METAL BOLLARDS (INTERIOR)

A. Metal bollards to be 4” Schedule 80 steel pipe x 48” long.

B. Fabricate bollards with 1/2-inch- thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 5/8-inch threaded rods.

2.8 LEVELING PLATES

A. Provide leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

2.9 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.10 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.11 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.3 INSTALLING METAL BOLLARDS

A. Anchor bollards to existing construction with securing/ leveling nuts. Provide four 5/8-inch threaded rod bolts at each bollard unless otherwise indicated.

1. Chemically anchor threaded rods at least 3.5 inches in concrete.

B. Fill bollards solidly with concrete, mounding top surface to shed water.

END OF SECTION 05 50 00

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SECTION 05 50 13.13 – INTERIOR CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior Chain-link fences.
2. Interior Swing gates.
3. Gate Hardware.
4. Base Plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Fence and gate posts, rails, and fittings.
b. Chain-link fabric, reinforcements, and attachments.
c. Gates and hardware.

B. Shop Drawings: For each type of fence and gate assembly.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include accessories, hardware, gate operation, and operational clearances.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of chain-link fence.

B. Sample Warranty: For special warranty.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.6 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Failure to comply with performance requirements.
   b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:

1. Fabric Height: As indicated on Drawings.
2. Steel Wire for Fabric: Wire diameter of 0.148 inch.

   a. Mesh Size: 2 inches.
   b. Zinc-Coated Fabric: ASTM A392, Type II, Class 1, 1.2 oz. /sq. ft. with zinc coating applied before weaving.
   c. Coat selvage ends of metallic-coated fabric before the weaving process with manufacturer's standard clear protective coating.

2.2 FENCE FRAMEWORK

A. Posts and Rails: ASTM F1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F1043 based on the following:

1. Fence Height: 6’-9-3/4” (as measured from existing concrete floor slab to top of top rail of fence system). Field verify that this dimension will not interfere with the bottom of existing mezzanine level joists

2. Heavy-Industrial-Strength Material: Group IA, round steel pipe, Schedule 40.
   a. Line Post: 2.375 inches in diameter
   b. End, Corner, and Pull Posts: 2.375 inches in diameter.

3. Horizontal Framework Members: Intermediate, top and bottom rails according to ASTM F1043.

   a. Rails: 1.66 inches in diameter.

4. Brace Rails: ASTM F1043.
5. Metallic Coating for Steel Framework:

a. Type A: Not less than minimum 2.0-oz./sq. ft. average zinc coating according to ASTM A123/A123M or 4.0-oz./sq. ft. zinc coating according to ASTM A653/A653M.

2.3 TENSION WIRE

A. Metallic-Coated Steel Wire: 0.177-inch-diameter, marcelled tension wire according to ASTM A817 or ASTM A824, with the following metallic coating:

1. Type II: Zinc coated (galvanized) by hot-dip process, with the following minimum coating weight:
   a. Matching chain-link fabric coating weight.

2.4 SWING GATES

A. General: ASTM F900 for gate posts and single and double swing gate types.

1. Gate Leaf Width: As indicated.

B. Pipe and Tubing:

1. Zinc-Coated Steel: ASTM F1043 and ASTM F1083; protective coating and finish to match fence framework
2. Gate Posts: Round tubular steel.
3. Gate Frames: Round tubular steel with O.D. of 1-3/8”

C. Frame Corner Construction: Welded

D. Hardware:

1. Hinges: 180-degree outward swing.
2. Locks: Provide each single swing and active swing gate leaf of paired gates with a Keyed Industrial Gate Lock to allow for free egress by level handled equal to Locinox LAKQU2 Series:

   a. Gate Lock:

      1) ISO 9227 KTL / E-coated lockbox withstands 1000 hours of salt spray test.
      2) Easy left or right hand changing of the self-latching bolt.
      3) Throw of 7/8" in 1 turn of the key.
      4) Key-operated self-latching bolt.
      5) 4-hole mounting with two hex head socket screws.
      6) Center distance between bolts: 2-3/8".
      7) Adjustment of the bolts up to 3/4" continuous without removing the lockbox.
      8) Stainless steel mechanism.

   b. Anchoring Security Gate Stop and Keeper for Swing Gate Locks

      1) Reinforced stainless steel security keep for round and square profiles.
      2) Stainless steel anchoring system.
      3) Stainless steel adjustable slam plate with shock rubber.
      4) Easy left or right hand changing.
      5) Innovative mounting: Quick-Fix.

6) Prevents opening the gate with a crowbar.
7) For square and round profiles.
8) Adjustable for profiles: 1-1/2" to 2-1/2

c. Adapter Plate, for Gate Lock, Square to Round, Aluminum
d. Adapter Plate, for Security Keeper, Square to Round, Aluminum
e. Chain Link Fence Tension Bar Adapter with beveled tension bands
f. Custom, 1/8” Galvanized steel plate latch guard sized and shaped to prevent operation of free egress lever from secure side.

1) Overall Size 16” W x 20” high.
2) Notched to fit around Chain Link Fence Tension Bar Adapter.
3) 1” radiused inside and outside corners.

3. Inactive Gate Leafs: Provide drop (cane) bolts with hasp for owner provided padlock.

a. Provide stainless or galvanized dust proof strikes for bolts

2.5 FITTINGS

A. Provide fittings according to ASTM F626.

B. Rail and Brace Ends: For each gate, corner, pull, and end post.

C. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails to posts.

D. Tension and Brace Bands: Pressed steel.

E. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

F. Tie Wires, Clips, and Fasteners: According to ASTM F626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:

a. Hot-Dip Galvanized Steel: 0.106-inch- diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

G. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. of zinc.

2.6 BASE PLATES

A. Provide 6” x 6” x 5/16” galvanized base plates for all vertical cantilevered post supports:

1. Line Post Base Plates: Drill holes for four (4) 1/ 2” threaded rods at each corner of plate.

a. Distance between hole centers shall be 4”

2. Corner and Jamb Post Base Plates: Drill holes for three (3) 1/ 2” threaded rods at three (3) corners of plate.
   a. Distance between hole centers shall be 4”.

3. Provide 1/ 2” Radius corners.
4. Grind smooth top edges of plate to a 1/8” wide bevel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements.

3.2 PREPARATION

A. Layout locations of base plates, fence lines, gates, and terminal posts.

1. Coordinate top fence height with bottom of mezzanine steel joists above.
2. Notify Architect if a minimum head room clearance of 6’-8” through gates cannot be achieved.
3. Do not locate any post locations directly under existing steel joist bottom members.
4. Post / Base Plates : All posts attachments to base plates shall be offset (not centered on base plates):
   a. Edges of base plates for line and corner posts shall not protrude more than 1/2” past edges of posts towards corridor- open room side of storage/tool rooms.
   b. Edges of base plates for gate jamb posts shall not protrude more than 1/2” past edges of posts on corridor- open room side of storage/tool rooms and also shall not protrude more than 1/2” past edges of posts towards gate openings.

B. Install chain-link fencing according to ASTM F567 and more stringent requirements specified.

C. Install galvanized steel base plates at all post locations utilizing four (4) or three (3) threaded 1/2” diameter galvanized steel rods plate embedded into existing concrete floor slab with minimum 3.5” embedment depth with chemical epoxy anchoring system providing a minimum pullout of 2,500 lbs. per anchor.

1. Utilize flat galvanized steel washers for shims to level plates.
2. For conditions where leveling cannot be achieved by shims, adjust end of post by beveling for vertical plumbness.
3. Refer to “Preparation” paragraph herein for offset base plate requirements.

D. Post Setting: Set posts by field welding to galvanize steel base plates

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during welding.

E. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F567 and terminal pull posts at changes in direction.

F. Line Posts: Space line posts uniformly at no more than 96 inches o.c.

G. Post Bracing and Intermediate Rails: Install according to ASTM F567, maintaining plumb position and alignment of fence posts.

1. Locate horizontal braces at midheight of fabric.

H. Tension Wire: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

1. Extended along bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.

I. Top Rail: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps.

J. Intermediate and Bottom Rails: Secure to posts with fittings.

K. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1-inch bottom clearance between existing concrete surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

L. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.

M. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

N. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.3 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Adjust hardware for smooth operation.
1. Drill hole for drop bolts of inactive leafs of paired swing gates drop bolts. Install dust-proof bolt strike.

3.4 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire

operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

END OF SECTION 05 50 13.13

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SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Steel Pipe fabricated guardrails
2. Wall Mounted Steel Pipe handrails

B. Related Requirements:

1. Section 09 91 00 ”Painting” for shop applied primers.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Handrail brackets.
2. Grout, anchoring cement, and shop primer products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E894 and ASTM E935.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.2 STEEL AND IRON

A. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for both interior and exterior installations.

B. Wall –Mounted and rails:1-3/8” Schedule 40 Steel Pipe

C. Guardrail Assemblies:

1. Top Rails and Posts: 1-5/8” Schedule 40 Steel Pipe
2. Intermediate Horizontal Rail: 1-3/8” Schedule 40 Steel Pipe
3. Handrails as part of Guardrail Assemblies

2.3 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

2.4 FABRICATION

A. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

B. Form work true to line and level with accurate angles and surfaces.

C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

D. Form changes in direction by bending.

E. Provide wall returns at ends of wall-mounted and integral guard rail handrails unless otherwise indicated.

2.5 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize steel railings, including hardware, after fabrication.
2. Comply with ASTM A123/A123M for hot-dip galvanized railings.

B. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

1. Comply with SSPC-SP16

C. Shop Primer: Provide gray shop primer compatible with water-based acrylic finish coat indicated in Section 09 91 00 “Painting”.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings.

1. Fit exposed connections together to form tight, hairline joints.

2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
7. Set posts plumb within a tolerance of 1/16 inch in 3 feet.

3.2 ANCHORING GUARD RAILINGS

A. Anchoring into Concrete: Core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of guard railing assemby's post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

1. Leave anchorage joint exposed with 1/8-inch (3-mm) buildup, sloped away from post

B. Anchor posts to steel structure:

1. Fully weld post ends to steel; dress welded connections smooth.

3.3 ATTACHING WALL MOUNTED RAILINGS

A. Attach handrails to walls with wall brackets Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.

1. Use type of bracket with predrilled hole for exposed bolt anchorage.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 52 13

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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. Wood blocking, grounds, and nailers.
2. Plywood backing panels.

1.3 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.

B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.5 QUALITY ASSURANCE

A. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

1. Dimension lumber framing.
2. Miscellaneous lumber.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency

certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood).

1. Use Exterior type for exterior locations and where indicated.
2. Use Interior Type A, unless otherwise indicated.

B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

C. Application: Treat the following:
1. Concealed blocking.
2. Plywood backing panels.

2.4 **MISCELLANEOUS LUMBER**

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Grounds.

B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber with 19 percent maximum moisture content and any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine; SPIB.
3. Spruce-pine-fir; NLGA.

C. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, 3/4" fire-retardant treated, nominal thickness.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, [grounds,]and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

D. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.

E. Do not splice structural members between supports, unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- (38-mm actual-) thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.

H. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

J. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 00

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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. Wall sheathing.
2. Parapet Wall Sheathing.

1.3 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Product: Subject to compliance with requirements, provide one of the following products:
   a. "Dens-Glass Gold" by G-P Gypsum Corporation.
   b. “Glasroc” by Certainteed.
   c. "Securock” by USG.
   d. Or an Approved Equal.
2. Type and Thickness: Regular, 1/2 inch thick.

3. Size: 48 by 96 inches for vertical installation.

2.2 VERTICAL PARAPET SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Product: Subject to compliance with requirements, provide one of the following products:
   a. "Dens-Deck" by G-P Gypsum Corporation.
   b. “Glasroc” by Certainteed.
   c. "Securock” by USG.
   d. Or an Approved Equal.
2. Type and Thickness: 5/8 inch thick.
3. Size: 48 by 96 inches for vertical installation.

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

B. Screws for Fastening Gypsum Sheathing to Insulating Concrete Forming System (ICF): Steel drill screws, in length recommended in writing by ICF manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

2.4 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing Board: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated, and complying with requirements for elastomeric sealants specified in Division 07 Section "Joint Sealants."

B. Sealant for Glass-Mat Gypsum Sheathing Board: Silicone emulsion sealant complying with ASTM C 834, compatible with PVC Roof Flashing Membrane, sheathing tape and sheathing, and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

C. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, minimum 2 inches wide of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
   1. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
   2. Horizontal Fastening shall be 8” o.c. to coordinate with the ICF system vertical attachment area.

D. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
   1. Fasten gypsum sheathing to the ICF system with screws.
   2. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.

3.3 SHEATHING JOINT-AND-PENETRATION TREATMENT

A. Seal sheathing joints according to sheathing manufacturer's written instructions.

   1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
   2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 06 16 00

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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. Plastic-laminate clad cabinets.

1.3 SUBMITTALS

A. Product Data: For high-pressure decorative laminate, adhesive for bonding plastic laminate, solid-surfacing material, cabinet hardware and accessories and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.

C. Samples for Initial Selection:

1. Plastic laminates.
2. PVC edge material.

D. Samples for Verification:

1. Plastic laminates, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
2. Thermoset decorative-panels, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with edge banding on 1 edge.
3. Solid-surfacing materials, 6 inches (150 mm) square.

E. Product Certificates: For each type of product, signed by product manufacturer.

F. Woodwork Quality Standard: Comply to AWI Quality Certification Standards.

G. Qualification Data: For Installer and fabricator.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products: Comply with the following:

1. Moisture Resistant Medium-Density Fiberboard: ANSI A208.2, Grade 150 made with binder containing no urea formaldehyde.
2. Exterior grade; 7-ply CAT PS1-09 Pine Sanded BC Plywood

C. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

2.2 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets. All cabinet hardware unless specifically noted otherwise, shall be manufactured by Blum, Hafele America Company or an approved equal.

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening.

C. Cabinet Pulls: Subject to the project requirements; provide square profile, back mounted, solid metal, cabinet pulls by one of the following:
1. Top Knobs: Nouveau Collection M1153; Square Bar Pull with 8-13/16'' C-C Spacing; Finish: Flat Black
2. Stanton: 625 192NB Square Bar Pull with 224 mm C-C spacing; Finis: Matt Black

D. Catches: Magnetic catches, BHMA A156.9, B03141.

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

F. Drawer Slides: BHMA A156.9, B05091.
1. Subject to the project requirements , provide drawer slides by Blum or by one of the following manufacturers:
   a. Grass
   b. Zargon
2. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-overtravel-extension type; zinc-plated steel ball-bearing slides.
3. Pencil Drawer Slides: Grade 2 to be used only for drawers not more than 3 inches high and 24 inches (600 mm) wide. Slides to be side mounted; full-overtravel-extension type; zinc-plated steel ball-bearing slides.

2.3 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

B. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

C. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Contact Adhesive: 250 g/L.

D. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Premium-grade interior woodwork complying with referenced quality standard.

2.5 PLASTIC-LAMINATE CABINETS

A. Grade: Premium.

B. AWI Type of Cabinet Construction: Flush overlay.

C. Substrate Materials:

1. Exterior grade; 7-ply CAT PS1-09 Pine Sanded AB Plywood.

D. Laminate Cladding for Exposed Surfaces: Subject to compliance with the requirements, provide the following laminate as designated on the drawings:

1. PLAM-1: Bea Kol Collection; Color: S0029B; Finish: TX, laminate as manufactured by PoliLam or comparable product by one of the following manufacturers:
   a. Arborite- P346RM Inukshuk Carbon
   b. Formica- 299-58-ML –Monolithic Finish

2. PLAM-2: Bea Kol Collection; Color: C0076 Finish: LA, laminate as manufactured by PoliLam or comparable product by one of the following manufacturers:
   a. Arborite- A405 CA –Black Noir
   b. Formica - Black Matte Finish 909-58

E. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS

a. Edges of Plastic-Laminate Shelves PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.
b. For semi exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.

2. Drawer Sides and Backs: Thermoset decorative panels.
3. Drawer Bottoms: Thermoset decorative panels.

2.6 COUNTERTOP SUPPORT BRACKETS

A. Countertop (not containing lavatories or sinks) Support Brackets: Subject to compliance with the requirements, SWS4, undercounter, powder coated metal, countertop support brackets as manufactured by Mockett or a comparable product by one of the following:
1. Federal Brace Co.
2. Or an approved equal.

B. Countertop Size: Sided for cantilevered counter top.

C. Color: Black

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use

pieces less than 60 inches long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
2. Install wall railings on indicated metal brackets securely fastened to wall framing.
3. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.
3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into blocking.

H. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch) sag, bow, or other variation from a straight line.
3. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
4. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

I. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

J. SHELVING AND CLOTHES ROD INSTALLATION

1. Install shelf brackets according to manufacturer's written instructions, spaced not more than 32 inches o.c. Fasten to framing members and blocking
2. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled. Install shelves, fully seated on brackets and supports.
3. Fasten shelves to brackets to comply with bracket manufacturer's written instructions.
4. Install rod flanges for rods as indicated. Install rods in rod flanges.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 40 23

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.
3. Testing Agency: UL.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PLASTIC SHEET PANELING (FRP-1)

A. General: Gelcoat-finished, glass-fiber reinforced plastic panels complying with ASTM D 5319.

1. Manufacturers: Subject to compliance with requirements, provide “Varietex” as manufactured by Crane Composites or a comparable product by one of the following manufacturers:
   a. Marlite: Standard FRP - Smooth
   b. Panolam: FRP- Smooth

2. Nominal Thickness: Not less than 0.09 inch.
3. Surface Finish: Smooth
4. Color: Cotton White.

2.2 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide inside corners, outside corners, and caps as needed to conceal edges.

1. Color: Match panels.

B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.

C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

D. Adhesive: As recommended by plastic paneling manufacturer.

1. VOC Content: 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Sealant: Single-component, mildew-resistant, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Division 07 Section "Joint Sealants."

1. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

B. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.

C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

D. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.

1. Mark plumb lines on substrate at trim accessory and panel joint locations for accurate installation.

3.3 INSTALLATION

A. Install panels in a full spread of adhesive.

B. Install trim accessories with adhesive. Do not fasten through panels.

C. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.

D. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

E. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.

F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 64 00

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SECTION 07 01 50.19 - PREPARATION FOR REROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of This Section Includes:

1. Complete roof tear-off of all existing roof systems including , but not limited to, the following:
   a. Existing base flashings and parapet wall roofing membranes/felts.
   b. Existing Unit Skylights and associated curbs.
   c. Existing Roof Curbs.
   d. Existing Equipment curbs.
   e. Existing Plumbing Vents.
   f. Other items indicated on demolition drawings and/or notated elsewhere.
2. Temporary roofing.
3. Disposal.

B. Related Requirements:

1. Section 01 10 00 "Summary" for hazardous materials that may be encountered in the preparation for reroofing.
2. Demolition Drawings for removal of roof top equipment, temporary removal of existing roof top equipment to remain.

1.2 DEFINITIONS

A. Full Roof Tear-off: Removal of existing roofing system down to existing roof deck.

B. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting removal Work, conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, roofing Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing tear-off, including, but not limited to, the following:
   a. Existing roof drains and roof drainage during each stage of reroofing, and roof-drain plugging and plug removal.
   b. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to avoid delays.
   c. Temporary removal of existing roof top HVAC equipment from roof
   d. Existing roof deck conditions requiring Architect notification.
   e. Existing roof deck removal procedures and Owner notifications.
   f. Condition and acceptance of existing roof deck.
   g. Structural loading limitations of roof deck during reroofing.

h. Discovery of asbestos-containing materials and precautions.
i. Governing regulations and requirements for insurance and certificates if applicable.
j. Existing conditions that may require Architect notification before proceeding.

1.4 INFORMATIONAL SUBMITTALS

A. Landfill Records: Indicate receipt and acceptance of demolished roofing materials and hazardous wastes, such as asbestos-containing materials, by a landfill facility licensed to accept them.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with governing EPA notification regulations before beginning roofing removal.
2. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.6 FIELD CONDITIONS

A. Existing Roofing System to be demolished: Built-up (upper roof area) and single-ply membrane (lower roof area) roofing.

B. Owner will not occupy portions of building immediately below reroofing area.

1. Before working over structurally impaired areas of deck, evacuate workers and other personnel from below affected area.

a. Verify that all workers and other personnel below work area have been evacuated before proceeding with work over impaired deck area.

C. Weather Limitations: Since there is a complete roof-tear off including complete roof steel deck replacement at the high roof area; there are limited weather limitations:

1. Remove base flashings and parapet roof membranes at the latest possible time to avoid water from entering the existing exterior walls. Provide temporary roof protection of roof perimeters until new roof system is ready to be installed.

2. Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering the existing exterior walls

D. Hazardous Materials:

1. It is expected that hazardous materials, such as asbestos-containing materials, will be encountered in the Work. Coordinate all roof tear off including, but not limited to, removal of existing copings with Contractor's North Carolina Accredited Asbestos Design Consultant required per Section 02 41 19 "Selective Demolition".
   a. Certain areas of the existing building's **exterior** wall elements have asbestos containing cement board materials and are to remain in a non-friable condition.
      1) Proceed with extreme caution when removing existing copings.
      2) Do not disturb and do not make friable any existing cement board material(s).

b. The existing building may have existing asbestos containing cement board at locations including, but not limited to, the roof side parapet wall separating the low roof area from the high roof area (along Column line E).
   1) Proceed with extreme caution when removing existing copings and base flashings parapet membranes.
   2) Do not disturb and do not make friable any existing cement board material(s).

2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

3. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
   a. Do not disturb hazardous materials or items suspected of containing hazardous materials except according to procedures specified elsewhere in the Contract Documents.

PART 2 - PRODUCTS

2.1 TEMPORARY ROOFING MATERIALS

A. Design and selection of materials for temporary roofing are Contractor's responsibilities.

B. Provide temporary roofing at parapet walls and perimeter of the roof until new roofing system(s) can be installed.

2.2 INFILL AND REPLACEMENT MATERIALS

A. Steel deck is specified in Section 05 31 00 "Steel Decking."

PART 3 - EXECUTION

3.1 ROOF TEAR-OFF

A. Lower removed roofing materials to ground and onto lower roof levels, using dust-tight chutes or other acceptable means of removing materials from roof areas.

B. Remove loose aggregate from aggregate-surfaced, built-up bituminous roofing using a power broom prior to removal of existing built-up roofing

C. Remove pavers and accessories from roofing.

D. Full Roof Tear-off: Remove existing roofing and other existing roofing system components down to the existing roof deck.

1. Remove entire roof system(s) to existing metal roof deck.
2. Remove metal roof deck where indicated
3. Remove base flashings and counter flashings.
4. Remove copings

a. Carefully remove Roof Copings in a manner that does not disturb the existing asbestos containing cement board panels or the existing treated wood nailer.
b. Notify Owner and Architect if the existing the existing treated wood nailer is in a deteriorated condition.

5. Remove flashings at pipes, curbs, mechanical equipment, and other penetrations.
6. Remove Unit Skylights and associated curbs.
7. Remove roof top equipment curbs.
8. Remove roof drains indicated on Drawings to be removed.

3.2 DECK PREPARATION

A. Inspect deck after tear-off of roofing system.

B. Lower roof area: if steel metal deck surface is unsuitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Architect.

1. Do not proceed with installation until directed by Architect.

2. Deck replacement will be paid for by adjusting the Allowance in the Contract Sum according to unit prices included in the Contract Documents.

C. Install temporary roofing at base/ perimeters of roof areas to protect existing exterior walls from damage.

D. Remove temporary roofing in sections during new roofing installation.

3.3 BASE FLASHING REMOVAL

A. Remove existing base flashings/parapet wall membranes/felts

1. Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.

2. If cement board is discovered, stop work immediately and notify Owner and Architect

B. Inspect parapet sheathing, wood blocking, curbs, and nailers for deterioration and damage.

1. If parapet sheathing, wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.

3.4 DISPOSAL

A. Collect demolished materials and place in containers.

1. Promptly dispose of demolished materials.
2. Do not allow demolished materials to accumulate on-site.
3. Storage or sale of demolished items or materials on-site is not permitted.

B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION 07 01 50.19

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Glass-fiber blanket insulation.
   2. Semi-Rigid Mineral-wool board insulation for insulation at Aluminum Composite Material Panel System
   3. Mineral-wool blanket insulation (Sound Attenuation Blankets).
   4. Mineral Wool Stuffings.

B. Related Sections include, but are not limited to, the following:

   1. Division 07; Section "Poly-Vinyl-Chloride (PVC) Roofing" for insulation specified as part of roofing construction
   2. Division 07; Section: "Water-Drainage Exterior Insulation And Finish System (EIFS)" for insulation specified as part of EIFS System.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

C. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

   1. Do not expose to sunlight except to necessary extent for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Unfaced, ASTM C665, Type I; passing ASTM E136 for combustion characteristics.

1. Subject to compliance with the requirements provide glass- fiber blanket insulation by one of the following:

   a. Owens Corning: Pink Next Gen Fiberglas Insulation
   b. Certainteed: CertaPro Sustainable Insulation
   c. Or an Approved Equal

2. Thickness: 6” with an R-Value of not less than R-19

2.2 SEMI-RIGID MINERAL WOOL BOARD INSULATION FOR RAINSCREEN USE

A. Mineral Wool Board Insulation, Type IVB per ASTM C612 with black fiberglass facing.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Rockwool: Cavityrock Black
   2. Owens Corning Thermafiber: Rain Barrier Dark HD
   3. Or an Approved Equal

C. Thickness: 2” with an R- value of not less than 8.6.

D. Size 16” x 48”.

E. Black Facer Rolls: Rolls of black fiberglass facing for sealing edges and vertical seams

2.3 MINERAL-WOOL BLANKET INSULATION (SOUND ATTENUATION BLANKETS)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Fibrex Insulations Inc.
   2. Owens Corning.
   3. Roxul Inc.
   4. Thermafiber.
   5. Or an Approved comparable product.

B. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 0 and 5, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. Type: Creased Sound Attenuation Fire Blanket.
2. R-Value: 3.7 per inch.
3. Density: 2.5 pcf (nominal) for thicknesses greater than 1”.
4. Surface Burning Characteristics: Unfaced- Flame Spread 0 and Smoke Developed 0.

2.4 MINERAL WOOL STUFFINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Fibrex Insulations Inc.
2. Owens Corning.
3. Roxul Inc.
4. Thermafiber; Insul-Fill
5. Or an Approved comparable product.

B. Loose Fill Mineral-Wool Insulation: ASTM C 665, Type I; consisting of fibers; with maximum flame-spread and smoke-developed indexes of 0 and 5, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. Type: Loose Stuffings
2. R-Value: 3.7 per inch.
3. Density: 2.5 pcf (nominal) for thicknesses greater than 1”.
4. Surface Burning Characteristics: Unfaced- Flame Spread 0 and Smoke Developed 0.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickeness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF GLASS FIBER INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

3.4 Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation

3.5 INSTALLATION OF SOUND ATTENUATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

C. Loose-Fill Insulation: Apply according to ASTM C 1015 and manufacturer's written instructions. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.

D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 24 19 - WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Water-drainage exterior insulation and finish system (EIFS) as part of Alternate No.1

1. EIFS-clad drainage-wall assemblies that are field applied over substrate.
2. Water-resistive barrier coatings.

B. Related Requirements:

1.2 DEFINITIONS

A. Definitions in ASTM E2110 apply to Work of this Section.

B. EIFS: Exterior insulation and finish system(s).

C. IBC: International Building Code.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each EIFS component, trim, and accessory, including water-resistive barrier coatings.

B. Shop Drawings:

1. Include details for EIFS buildouts.
2. Include details for parapet cap flashing.

C. Samples: For each exposed product and for each color and texture specified, 8 inches square in size.

D. Samples for Initial Selection: For each type of finish-coat color and texture indicated.

1. Include similar Samples of exposed accessories involving color selection.

E. Samples for Verification: 24-inch-square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work, including custom trim, each profile, and an aesthetic reveal.

1. Include exposed trim and accessory Samples to verify color selected.

2. Include a typical control joint filled with sealant of color selected, as specified in Section 07 92 00 "Joint Sealants."

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Manufacturer Certificates: Signed by EIFS manufacturer, certifying the following:

1. EIFS complies with requirements.
2. Substrates to which EIFS is indicated to be attached are acceptable to EIFS manufacturer.
3. Accessory products installed with EIFS, including joint sealants, flashing, water-resistive barrier coatings, trim, whether or not furnished by EIFS manufacturer and whether or not specified in this Section, are acceptable to EIFS manufacturer.

C. Product Certificates: For insulation and joint sealant, from manufacturer.

D. Product Test Reports: For each EIFS assembly and component, and for water-resistive barrier coatings, for tests performed by a qualified testing agency.

E. Field quality-control reports.

F. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For EIFS to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An installer who is certified in writing by AWCI International as qualified to install Class PB EIFS using trained workers.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.

B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.

1. Stack insulation board flat and off the ground.
2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1. Proceed with installation of adhesives or coatings only when ambient temperatures have remained, or are forecast to remain, above 40 deg F for a minimum of 24 hours before, during, and after application. Do not apply EIFS adhesives or coatings during rainfall.

1.10 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of EIFS-clad drainage-wall assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Bond integrity and weathertightness.
b. Deterioration of EIFS finishes and other EIFS materials beyond normal weathering.

2. Warranty coverage includes the following components of EIFS-clad drainage-wall assemblies:

a. EIFS finish, including base coats, finish coats, and reinforcing mesh.
b. Insulation installed as part of EIFS.
c. Insulation adhesive.
d. EIFS accessories, including trim components and flashing.
e. Water-resistive barrier coatings.
f. EIFS drainage components.

3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

A. Subject to compliance with the requirements, provide water-drainage EIFS system as manufactured by one of the following:

1. Sto Corporation: StoTherm CI
2. Dryvit (Tremco): Outsulation Plus MD
3. Parex USA: Optimum WaterMaster CI

B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with EIFS components.

2.2 PERFORMANCE REQUIREMENTS

A. EIFS Performance: Comply with ASTM E2568 and with the following:

1. Weathertightness: Resistant to uncontrolled water penetration from exterior, with a means to drain water entering EIFS to the exterior.
2. Extruded Polystyrene (EPS) Insulation shall conform with ASTM E2430 and ASTM C578 Type I requirements. R-value to be R-3.6 per inch thickness at 75°F.
3. System Fire Performance: Meets flame propagation criteria for use on Types I, II, III, IV construction (refer to ICC-ESR 1748 for details).
4. Structural Performance of Assembly and Components:

    a. Wind Loads:
        1) Uniform pressure as indicated on Drawings.

5. Impact Performance: ASTM E2568, High impact resistance.
6. Abrasion Resistance of Finish Coat: Sample consisting of 1-inch-thick EIFS mounted on 1/2-inch-thick gypsum board; cured for a minimum of 28 days and shows no cracking, checking, or loss of film integrity after exposure to 528 quarts of sand when tested in accordance with ASTM D968, Method A.
7. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch clean glass substrate; cured for 28 days and shows no growth when tested in accordance with ASTM D3273 and evaluated in accordance with ASTM D3274.
8. Drainage Efficiency: 90 percent average minimum when tested in accordance with ASTM E2273.

2.3 EIFS MATERIALS

A. Water-Resistive Barrier Coating: EIFS manufacturer's standard formulation and accessories for use as water-resistive barrier coating; compatible with substrate.

1. Water-Resistance: Comply with physical and performance criteria of ASTM E2570/E2570M.

B. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt, and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.

C. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; specifically formulated to be applied to back side of insulation in a manner that creates open vertical channels designed to serve as an integral part of the water-drainage system of the EIFS-clad drainage-wall assembly; compatible with substrate; and complying with one of the following:

1. Job-mixed formulation of portland cement complying with ASTM C150/C150M, Type I, and polymer-based adhesive specified for base coat.
2. Factory-blended dry formulation of portland cement, dry polymer admixture, and fillers specified for base coat.

D. Molded, (Expanded) Rigid Cellular Polystyrene Board Insulation: Comply with ASTM E2430/E2430M, unless otherwise noted, and the following:

1. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, in accordance with ASTM E84.
2. Dimensions: Provide insulation boards of not more than 24 by 48 inches, with average thickness of 3 inches

E. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. in accordance with ASTM E2098/E2098M and the following:

1. Reinforcing Mesh for EIFS, General: Not less than weight required to comply with impact-performance level specified in "Performance Requirements" Article.
2. Strip-Reinforcing Mesh: Not less than as recommended by EIFS manufacturer for high impact system.
3. Detail-Reinforcing Mesh: Not less than as recommended by EIFS manufacturer for high impact system.
4. Corner-Reinforcing Mesh: Not less than as recommended by EIFS manufacturer for high impact system.

F. Base Coat: EIFS manufacturer's standard mixture complying with one of the following:

1. Job-mixed formulation of portland cement complying with ASTM C150/C150M, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.

G. Water-Resistant Base Coat: EIFS manufacturer's standard water-resistant formulation complying with one of the following:

1. Job-mixed formulation of portland cement complying with ASTM C150/C150M, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.

H. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.

I. Finish Coat: EIFS manufacturer's standard acrylic-based coating with enhanced mildew resistance complying with the following:

1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
2. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, and fillers used with stone particles for embedding in finish coat to produce an applied-aggregate finish.

    a. Aggregate: Marble chips of size and color as selected by Architect from manufacturer's full range.

3. Colors: As selected by Architect from Manufacturer’s full range of colors.
4. Textures: Light Sand

J. Sealer: Manufacturer's waterproof, clear acrylic-based sealer for protecting finish coat.

K. Water: Potable.

L. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D1784, manufacturer's standard cell class for use intended, and ASTM C1063.

1. Casing Bead: Prefabricated, one-piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
2. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
3. Weep Screed/Track: Prefabricated, one-piece type for attachment behind insulation with perforated face leg extended to form a drip and weep holes in track bottom, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg; designed to drain incidental moisture that gets into wall construction to the exterior at terminations of EIFS with drainage.
4. Expansion Joint: Closed-cell polyethylene backer rod and elastomeric sealant 3/4-inch-minimum.
5. Windowsill Flashing: Prefabricated type for both flashing and sloping sill over framing beneath windows; with end and back dams; designed to direct water to exterior.

2.4 MIXING

A. Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials, except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Begin coating application only after surfaces are dry.
2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.

B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind drainage plane of EIFS and deterioration of substrates.

C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

3.3 INSTALLATION OF EIFS, GENERAL

A. Comply with ASTM C1397, ASTM E2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

3.4 APPLICATION OF SUBSTRATE PROTECTION

A. Water-Resistive Barrier Coating: Apply over glass matt facedm gypsum sheating to provide a water-resistive barrier.

1. Tape and seal joints, exposed edges, terminations, and inside and outside corners of sheathing unless otherwise indicated by EIFS manufacturer's written instructions.

B. Flexible-Membrane Flashing: Install over water-resistive barrier coating, applied and lapped to shed water; seal at openings, penetrations, and terminations. Prime substrates with flashing primer if required and install flashing.

3.5 INSTALLATION OF TRIM

A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, at windowsills, and elsewhere as indicated. Coordinate with installation of insulation.

1. Weep Screed/Track: Use at bottom termination edges, at window and door heads of water-drainage EIFS unless otherwise indicated.
2. Windowsill Flashing: Use at windows unless otherwise indicated.
3. Expansion Joint: Use where indicated on Drawings.
4. Casing Bead: Use at other locations.

3.6 INSTALLATION OF INSULATION

A. Board Insulation: Adhesively attach insulation to substrate in compliance with ASTM C1397 and the following:

1. Apply adhesive to insulation by notched-trowel method, with notches oriented vertically to produce drainage channels that remain functional after the insulation is adhered to substrate.

2. Apply insulation over substrates in courses with long edges of boards oriented horizontally.
3. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
4. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints, so no piece of insulation is less than 12 inches wide or 6 inches high. Offset joints not less than 6 inches from corners of window and door openings and not less than 4 inches from aesthetic reveals.

    a. Adhesive Attachment: Offset joints of insulation not less than 6 inches from horizontal and 4 inches from vertical joints in sheathing.
5. Interlock ends at internal and external corners.
6. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
7. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
8. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/16 inch from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch. Prevent airborne dispersal and immediately collect insulation raspings or sandings.
9. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch.
10. Interrupt insulation for expansion joints where indicated.
11. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
12. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.
13. Before installing insulation and before applying field-applied reinforcing mesh, fully wrap board edges. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches over front and back face unless otherwise indicated on Drawings.
14. Treat exposed edges of insulation as follows:

    a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
    b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
    c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.

15. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and water-resistive barrier coating.

B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:

1. At expansion joints in substrates behind EIFS.
2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
3. At floor lines in multilevel wood-framed construction.
4. Where wall height or building shape changes.
5. Where EIFS manufacturer requires joints in long continuous elevations.

3.7 APPLICATION OF BASE COAT

A. Water-Resistant Base Coat: Apply full-thickness coverage to exposed insulation and to exposed surfaces of window sills and to other surfaces indicated on Drawings.

B. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C1397. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.

C. Double-Layer Reinforcing-Mesh Application: Where required for high-impact design, apply second base coat and second layer of reinforcing mesh, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C1397 in same manner as first application. Do not apply until first base coat has cured.

D. Additional Reinforcing Mesh: Apply strip-reinforcing mesh around openings, extending 4 inches beyond perimeter. Apply additional 9-by-12-inch strip-reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch-wide, strip-reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches on each side of corners.

1. At aesthetic reveals, apply strip-reinforcing mesh not less than 8 inches wide.
2. Embed strip-reinforcing mesh in base coat before applying first layer of reinforcing mesh.

E. Double Base-Coat Application: Apply second base coat in same manner and thickness as first application, except without reinforcing mesh. Do not apply until first base coat has cured.

3.8 APPLICATION OF FINISH COAT

A. Primer: Apply over dry base coat.

B. Finish Coat: Apply full-thickness coverage over dry primed base coat, maintaining a wet edge at all times for uniform appearance, to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

1. Embed aggregate in finish coat to produce a uniform applied-aggregate finish of color and texture matching approved sample.

C. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.

3.9 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Water-resistive barrier coatings applied over sheathing.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. EIFS Tests and Inspections: In accordance with ASTM E2359/E2359M

D. EIFS will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 CLEANING AND PROTECTION

A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION 07 24 19

SECTION 07 27 26 – FLUID-APPLIED MEMBRANE AIR BARRIERS

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. Fluid-applied, water-based, membrane air barrier

B. Related Sections include, but are not limited to, the following:
1. Division 04 Section “Unit Masonry”
2. Division 06 Section “Sheathing”
3. Division 07 Section “Sheet Metal Flashing and Trim”

1.3 DEFINITIONS

A. ABAA: Air Barrier Association of America.

B. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

C. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

1.4 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous, fire propogation resisting, vapor-permeable, air barrier and as a liquid-water drainage plane flashed to discharge to the exterior, incidental condensation or water penetration.

1. Shall not deteriorate due to interment exposure to UV; membrane to be dark-colored and designed for exposure to indirect and intermittent sunlight, such as behind open joint rain screen systems.

B. Provide materials that have been tested and pass the NFPA 285 “Standard Fire Test for Evaluation of Fire Propagation Characteristics of Exterior Non-load-bearing Wall Assemblies Containing Combustible Components.

1.5 SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.

B. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

C. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.

D. Qualification Data: For Applicator.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers.

1.6 QUALITY ASSURANCE

A. Manufacturer: Air barrier systems shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of waterproofing and air barriers. Manufacturers proposed for use, but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past five years.

B. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance and that is an ABAA-licensed contractor, employs certified and registered installers, and complies with ABAA's Quality Assurance Program .

C. Preinstallation Conference: Conduct conference at Project site.

1. A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Preinstallation conference shall include the Contractor, installer, Architect, and system manufacturer's technical field representative. Agenda for meeting shall include but not be limited to the following:
2. Review of submittals:
   a. Review of surface preparation, minimum curing period and installation procedures
   b. Review of special details and flashings
   c. Sequence of construction, responsibilities and schedule for subsequent operations
3. Review of inspection, testing, protection and repair procedures
4. Include installers of other construction connecting to air barrier, including insulating concrete forms, waterproofing, masonry, sealants, windows, glazed curtain walls, and door frames.
5. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

D. Compatibility Testing: Perform field compatibility testing of fluid-applied membrane air barriers and its system components on the job-site samples of the insulated foam used in the insulating concrete forms system.

1. Manufacturer’s Technical Representative of the Fluid-Applied membrane air barrier shall be present for witnessing the field compatibility test.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.

B. Remove and replace liquid materials that cannot be applied within their stated shelf life.

C. Store rolls according to manufacturer's written instructions.

D. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 FLUID-APPLIED MEMBRANE AIR BARRIER

A. Fluid-Applied, Fire Resistive, Vapor-Permeable Membrane Air Barrier:,
   1. Products: Subject to compliance with requirements, provide one of the following:

      a. Henry Company; Air-Bloc All Weather STPE
      b. W.R.Meadows; Air-Shield LMP (Black)
      c. Or an Approved Equal.

   2. Physical and Performance Properties:
      a. Membrane Air Permeance: ASTM E2178: Not to exceed 0.0004 cfm/sq. ft. under a pressure differential of 0.3 in. water (1.57 psf) (equal to 0.002 L/s. x sq. m. @ 75 Pa)
      b. Assembly Performance: Provide a continuous air barrier assembly that has an air leakage not to exceed 0.0008 cfm/sq. ft. of surface area under a pressure differential of 0.3 in. water (1.57 psf) (equal to 0.004 L/s. x sq. m. of surface area at 75 Pa) when tested in accordance with ASTM E2357.
      c. Membrane Vapor Permeance: ASTM E96, Method B: 11.2 perms
      d. Peel Adhesion: ASTM D903: min. 5 pli or substrate failure to glass faced wall board, min. 20 pli to concrete/CMU
      e. Pull Adhesion: ASTM D4541: min. 50 psi or substrate failure to foam insulation, min. 200 psi to concrete/CMU
      f. Nail Sealability: ASTM D1970: Pass
      g. Low temperature flexibility and crack bridging: ASTM C836: Pass at -15F (-26C)
      h. Water Penetration:
      i. Color: Black or Blackish green
      j. Fire Propagation Characteristics: Passes NFPA 285 Multi-story Fire Test.

2.2 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid waterborne primer recommended for substrate by manufacturer of air barrier material.

C. Joint Reinforcing Strip: Air barrier manufacturer's glass-fiber-mesh tape.

D. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

E. Adhesive and Tape: Air barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

A. Joint Sealant: Use sealant types as recommended by membrane air barrier compatible with all materials. Comply with Division 07 Section "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare (roughen),treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.
1. Special preparation for the application of the membrane air barrier directly to foam insulation.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT AND CRACK TREATMENT

A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.

1. Prime substrate and apply a single thickness of preparation coat strip extending a minimum of 3 inches (75 mm) along each side of joints and cracks. Apply a double thickness of air barrier membrane and embed a joint reinforcing strip in preparation coat.

2. Trowel Apply

B. Foam Insulation: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air barrier manufacturer's written instructions.

C. Exterior Fire Resistive Plywood and Glass Mat Faced Gypsum Sheathing : Prepare surface and joints of sheathing per fluid-applied membrane air barrier manufacturer including prime

3.4 TRANSITION STRIP INSTALLATION

A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.

C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

E. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply [elastomeric flashing sheet so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames with not less than 1 inch (25 mm) of full contact.
   1. Elastomeric Flashing Sheet: Apply adhesive to wall, frame, and flashing sheet. Install flashing sheet and termination bars, fastened at 6 inches (150 mm) o.c. Apply lap sealant over exposed edges and on cavity side of flashing sheet.

G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

I. Seal at through wall flashing vertical terminations; apply primers and membrane over vertical cavity leg of through wall flashing.

J. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

K. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.5 AIR BARRIER MEMBRANE INSTALLATION

A. Apply air barrier membrane to form a seal with strips and transition strips and to achieve a continuous air barrier according to air barrier manufacturer's written instructions.

B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.

C. Apply water-based primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.

D. Apply a continuous unbroken air barrier to substrates according to the following minimum thickness. Apply membrane in full contact around protrusions such as masonry ties.

1. Vapor-Permeable Membrane Air Barrier: 90-mil (2.4-mm) wet film thickness, 42~45-mil (1.2-mm) dry film thickness.

E. Apply according to air barrier manufacturer's written instructions.

F. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

G. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.6 FIELD QUALITY CONTROL

A. Inspections: The liquid applied air membrane manufacturer’s Technical Field Representative shall perform (2) site visits to visually inspect the application of the air barrier system as follows:
1. (1) visit to occur at the start of the air barrier membrane’s application
2. (1) visit to occur at 50% completion of the air barrier application.
3. Technical Field Representative shall write a visual inspection report including any deficiencies observed and submit report to the Contractor, Architect, and the Owner.
4. The manufacturer’s Technical Field Representative Visual Inspection Report to include the following items:
   a. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
   b. Continuous structural support of air barrier system has been provided.
   c. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions, and mortar droppings.

d. Site conditions for application temperature and dryness of substrates have been maintained.
e. Maximum exposure time of materials to UV deterioration has not been exceeded.
f. Surfaces have been primed, if applicable.
g. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
h. Termination mastic has been applied on cut edges.
i. Strips and transition strips have been firmly adhered to substrate.
j. Compatible materials have been used.
k. Transitions at changes in direction and structural support at gaps have been provided.
l. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
m. All penetrations have been sealed.

3.7 CLEANING AND PROTECTION

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than the manufacturer’s written amount of days.
2. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, flexible PVC membranes, and sealants not approved by air barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION 07 27 26

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SECTION 07 42 13.23 – ALUMINUM COMPOSITE MATERIAL PANEL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Aluminum composite material (ACM) wall panel rain screen system.
2. Repair/ Re-finishing of existing metal composite system.
3. Pultruded Fiberglass Horizontal Girt Support System

1.3 DEFINITIONS

A. ACM: Aluminum composite material; cladding material formed by joining two thin metal skins to polyethylene core and bonded under precise temperature, pressure, and tension.

1.4 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, metal composite material panel Installer, metal composite material panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal composite material panels, including installers of doors, windows, and louvers.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal composite material panel installation, including manufacturer's written instructions.
   4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal composite material panels.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include fabrication and installation layouts of aluminum composite material panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
   1. Include design calculation and engineered system drawings signed and sealed by the delegated design engineer.

C. Samples: For each type of metal composite material panel indicated.

1.6 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Warranties: Samples of special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.8 QUALITY ASSURANCE

A. Fabricator/Installer Qualifications: An entity that designs, fabricates and installs aluminum composite material wall panel systems.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal composite material panel systems that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal composite material panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E330:
   1. Wind Loads: As indicated on Drawings.
   2. Other Design Loads: As indicated on Drawings.
   3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Delegated Design: Engage a qualified professional engineer, licensed in the State of North Carolina, to design Aluminum Composite Material wall panel system.

2.2 ALUMINUM COMPOSITE MATERIAL PANELS

A. Aluminum Composite Material Panel Systems-General: Provide factory-formed and -assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment components, and accessories required for rain screen edge capture system.

B. Subject to compliance with the requirements, provide Alucabond Plus as manufactured by 3A Composites USA or a comparable product by one of the following:
   1. Reynobond
   2. Alpolic

C. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch-thick, aluminum sheet facings.
   1. Panel Thickness: 0.157 inch
   2. Core: PE
   3. Exterior Finish: Three-coat fluoropolymer.

D. Attachment Assembly: Edge Capture System, a rainscreen system, that utilizes extruded aluminum profile perimeter framing members with integral, offset “H” shape flanges to receive sealant and retain panel edges on all panel sides.

   1. Aluminum Extrusions: Provide manufacturer’s standard Aluminum 6063T extrusions to edge capture system while producing narrow reveals horizontally and vertically for panel to panel joints, panel end/top joints, 90^{O}-degree corners and bottom (sill) terminations

      a. Provide custom extrusions for curve panel to flat panel non-90^{O}- degree corners.

2.3 PULTRUDED FIBERGLASS REINFORCED POLYMER (PFRP) (HORIZONTALLY ORIENTED) CLADDING SUPPORT SYSTEM

A. Material: The PFRP cladding support systems shall be manufactured using:

   1. A pultruded process utilizing premium polyester resin with additional flame retardant additives.
   2. E or E-CR glass rovings and continuous filament mat.
   3. UV Inhibitors added
   4. Synthetic surface veil fabric shall encase the glass reinforcement.
   5. Girt Shape (Profile): Offset “H” Profile.
   6. Girt Width: Nominal width of 2.4” to accommodate an insulation thickness of 2”.

B. Girt Spacing: Nominally 16” for a slight snug fit (no bowing) to accommodate a 24” wide rain-screen type, semi –rigid mineral wool insulation board.

C. Provide small self-draining weep holes allowing any water in channel to drain.

D. Minimum Properties:

Property	Test Method	Minimum Value*
Tensile Strength (LW), psi	ASTM D 638	30,000
Tensile Modulus (LW), psi	ASTM D 638	2.5×10^6
Short Beam Shear Strength (LW), psi	ASTM D 2344	4,500
Screw Pullout Load*, lbf	ASTM D 7332	862
Flammability Classification	UL-94	V-0
Flame Spread Index	ASTM E-84	25 or less
Self -Extinguishing	ASTM D-635	Yes
Thermal Conductivity+ , BTU-in/ft^2-Hr/°F	ASTM C177	4

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide standard sections as required for support and alignment of aluminum composite material panel system.

B. Panel Accessories: Provide components required for a complete, panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish aluminum composite material panels unless otherwise indicated.

C. Flashing and Trim: Provide flashing and trim formed from same aluminum material as aluminum composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, base, drip and end wall flashing. Finish flashing and trim with same finish system as adjacent metal composite material panels.
   1. Provide .064” thick aluminum flat trim at base of wall panel system; finished to match adjacent aluminum composite material wall panel finish.

D. Extruded Aluminum Frame Fasteners: Self-tapping screws designed to withstand design loads.

D. Panel Sealants: ASTM C920; as recommended in writing by aluminum composite material panel manufacturer. Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

2.5 FABRICATION

A. General: Fabricate and finish metal composite material panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Curve new ACM panels and roll horizontal extrusions at main façade (“North” Elevation 1/A2.01) to match radius of existing curved fascia above.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.6 FINISHES

A. Panels and extruded aluminum perimeter frames:
   1. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   2. Colors:
      a. Color 1: Custom Yellow Color to be selected by Architect from RAL Color Index
      b. Color 2: Color as selected by Architect from manufacturers list of 24 standard colors

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal composite material panel manufacturer's written recommendations.

3.2 ALUMINUM COMPOSITE MATERIAL PANEL INSTALLATION

A. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
   1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

B. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.

C. Accessory Installation: Install accessories with positive anchorage to building and provide for thermal expansion. Coordinate installation with flashings and other components.

D. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

3.3 REPAIR AND REFINISHING OF EXISTING METAL COMPOSITE PANELS (MCM)

A. Repair existing holes and other defects in existing metal composite panels indicated to be refinished.
   1. Utilize bondo and associated filler to repair holes and dents.
   2. Sand smooth.

B. Sand all existing MCM surfaces to abrade existing for adhesion of primer

C. Prime all existing MCM surfaces with primer recommended by finish coating manufacturer.

D. Paint existing, primed MCM surfaces with Color 2 Three-Coat Fluoropolymer used for the new ACM panel system.

3.4 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 07 42 13.23

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Adhered PVC membrane roofing system.
2. Vapor retarders.
3. Roof insulation.
4. Roof Accessories.

B. Related Sections:

1. Division 06 Section “Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 07 Section "Preparation for reroofing" for complete tear off of existing roofing.
3. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings.
4. Division 07 Section "Roof Specialties" for copings.
5. Division 07 Section "Roof Accessories" for equipment curbs
6. Division 07 Section "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
7. Division 22 Section "Storm Drainage Piping Specialties" for roof drains.

1.3 REFERENCES

A. Refer to the following references, current edition for specification compliance:

1. 2018 North Carolina Building Code
2. ASTM International
3. National Roofing Contractors Association (NRCA)
4. Underwriters Laboratory (UL)
5. FM Global
6. ANSI/Single Ply Roofing Institute (ANSI/SPRI)

1.4 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to

defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE-7-10 and in accordance with Design Loads indicated on the drawings.

D. FMG Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FMG Approvals 4450 and FMG Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.

1. Fire/Windstorm Classification for Roof Systems RS-01 and RS-02: Class 1A-90
2. Hail Resistance: SH.

E. Energy Performance: Provide roofing system with three-year aged Solar Reflectance Index (SRI) not less than 90 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

F. R-Value of Insulation: Insulation shall provide a minimum aged R Value of R-5.7 per inch of insulation.

G. PVC Formulation: The formulation used in the manufacture of roofing membrane(s) prior to its manufacturing shall have remained unchanged for a period of time not less than the warranty period.

H. Expansion Joints at roof membrane interfaces to new parapet walls: All Roof Systems shall incorporate the manufacturer’s standard expansion joint utilizing a foam rod that at perimeter interfaces with new parapets. Joint shall allow for vertical movement of +/- 3/4 of an inch.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened components.
4. Adhesion patterns for corner, perimeter, and field-of-roof locations.

C. Samples for Verification: For the following products:

1. Sheet roofing, of color specified, including T-shaped side and end lap seam.
2. Roof insulation.
3. Walkway pads or rolls.
4. Metal termination bars.

5. Six insulation fasteners of each type, length, and finish.
6. Six roof cover fasteners of each type, length, and finish.

D. Qualification Data: For qualified Installer and manufacturer.

E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of compliance with performance requirements.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.

G. Research/Evaluation Reports: For components of membrane roofing system, from the ICC-ES.

H. Field quality-control reports.

I. Maintenance Data: For roofing system to include in maintenance manuals.

J. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for membrane roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

C. Source Limitations: Obtain components including roof insulation, fasteners, adhesives, cover boards, and other accessories for membrane roofing system from same manufacturer as membrane roofing or that are approved by membrane roofing manufacturer.

D. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

E. Installation/ Inspection Meetings: Provide up to five (5), separate on-site meetings/ inspections with Owner, General Contractor, Roofing Contractor, Roofing Manufacturer’s Authorized Field Representative, and Architect during the installation. Meetings/ Inspections shall occur as follows:
1. After insulation/ nailer installation
2. During membrane installation
3. During flashing installation

F. Final Roof Inspection: Refer to Part 3- Execution; “Field Quality Control” for Final Roof Inspection. Inspection shall be scheduled in advance and attended by Owner, General Contractor, Roofing Contractor, Roofing Manufacturer’s Authorized Field Representative, and Architect.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, non-prorated, without monetary limitation (NDL) or deductible, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks or breaches in the primary roof membrane causing moisture to enter the substrate below (even if visible leaks are not observed inside the facility). Warranty to remain in effect for wind speeds up to 72 mph. Warranties requiring the Owner’s signature will not be acceptable.

1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners-adhesives, cover boards, roofing accessories, and other components of membrane roofing system.
2. Warranty shall acknowledge 1/8” per foot slope is acceptable for warranted system with no exlusions.
3. Warranty Period: Twenty (20) years from date of Substantial Completion.
4. The membrane manufacturer’s PVC Formulation shall not have been changed for the preceding twenty years prior to the Project Start date.
5. No third party warranties will be permitted.
6. All Warranty work must be supported by an authorized representative of the Manufacturer within 25 miles of Project Site.
7. Manufacturer's Representative shall attend two post construction field inspections: the first no earlier than twenty -three (23) months and no later than twenty-four (24) months after the date of Substantial Completion and the second no earlier than fifty-nine (59) months and no later than sixty (60) months. Submit a written report within seven (7) days of the site visits to the Owner listing observations, conditions and any recommended repairs or remedial action.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

1. Warranty Period: Five (5) years from date of Substantial Completion.

1.10 BASIC DESCRIPTION OF ROOF SYSTEM TYPES (RS)

A. Roof Type RS-01: A 60 mil thick PVC membrane with fleece/felt backing that is fully adhered to a cover board that is fully adhered to 1/4" per foot tapered/flat polyisocyanurate insulation boards (including tapered crickets/saddles) that are mechanically through-fastened to the existing roof deck except where patched with new replacement metal roof deck.

B. Roof Type RS-02: Same as Roof Type RS-01 except the roof deck is existing at within 6 feet of the perimeter and everywhere else is new roof deck.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Subject to compliance with requirements provide a PVC Roofing System by one of the following manufacturers:
   1. Sika Sarnifil
   2. Carlisle Syntec
   3. Flex (Flex) Membranes International

2.2 MEMBRANE MATERIALS

A. Adhered Membrane and Components:

   1. Membrane:
      a. Sika Sarnafil 60-mil G410 Feltback
      b. Carlisle FleeceBack PVC FRS 60-mil Membrane
      c. Flex Fleece Back (FB) 60-mil PVC
   2. Color: White meeting the Energy Performance requirements herein.
   3. Membrane Adhesive: Shall be membrane manufacturer's solvent based adhesive. Water based adhesive shall not be utilized in temperatures below 40 degrees F.
      a. Sika Sarnafil Sarnacol 2170
      b. Carlisle Sure-Flex PVC Low VOC Bonding Adhesive
      c. Flex LA432M

2.3 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.

   1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
   2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

      a. Plastic Foam Adhesives: 50 g/L.
      b. Gypsum Board and Panel Adhesives: 50 g/L.

c. Multipurpose Construction Adhesives: 70 g/L.
d. Fiberglass Adhesives: 80 g/L.
e. Contact Adhesive: 80 g/L.
f. Other Adhesives: 250 g/L.
g. PVC Welding Compounds: 510 g/L.
h. Adhesive Primer for Plastic: 650 g/L
i. Single-Ply Roof Membrane Sealants: 450 g/L.
j. Nonmembrane Roof Sealants: 300 g/L.
k. Sealant Primers for Nonporous Substrates: 250 g/L.
l. Sealant Primers for Porous Substrates: 775 g/L.

A. Flashing/Stripping Membrane: Shall be a non fleece-back, thermoplastic membrane reinforced with fiberglass. Utilize asphalt resistant flashing membrane where in contact with residual asphaltic materials or as required by the manufacturer.

1. Sika Sarnafil 60-mil G410
2. Carlisle Sure-Flex KEE HP 60-mil Membrane
3. Flex MF/R 60 PVC

B. Flashing Adhesive: Shall be membrane manufacturer's solvent based adhesive.

1. Sika Sarnafil Sarnacol 2170
2. Carlisle Sure-Flex PVC Low VOC Bonding Adhesive
3. Flex LA432M

C. T-joint Patch: Shall be membrane manufacturer's circular patch welded over T-joints formed by overlapping thick membranes.

D. Corner Flashing: Shall be membrane manufacturer's pre-formed inside and outside flashing corners that are heat-welded to membrane or polymer clad metal base flashings.

E. Pipe Flashing: Shall be membrane manufacturer's pre-formed pipe boot flashing that is heat-welded to membrane and secured with a stainless steel draw band and sealant.

F. Termination Bar: Shall be manufacturer's 1/8" by 1" mill finish extruded aluminum bar with pre-punched slotted holes.

G. Counterflashing Bar: Shall be a prefabricated extruded aluminum metal counterflashing and termination bar. 0.10"-0.12" thick bar with 2-1/4" profile, pre-drilled holes 8" on center and sealant kick out at top edge.

H. Expansion Joint at roof perimeter interfaces with new parapet walls: Shall utilize foam tubing compatible with membrane flashing strip.

I. Sealant: Shall be manufacturer's multi-purpose sealant.

J. Fasteners:

1. Flashing Membrane Termination Screws: #12 corrosion resistant hex or pan head screws with length to penetrate substrate a minimum of 1-1/2".
2. Concrete and Masonry Flashing Membrane Termination Anchors:

a. 1/4" diameter metal based expansion anchor with stainless steel pin of length to penetrate substrate a minimum of 1-1/2".

b. Masonry screws, approved my membrane manufacturer, 1/4-inch minimum diameter, corrosion resistant, with Phillips flat head. Length to provide minimum 1-1/2" embedment into substrate.

3. Steel Deck Fasteners and Plates: Shall be #12 corrosion resistant pan head screw approved by membrane manufacturer of length to penetrate top flange of steel deck a minimum of 1" with galvalume plates approved for membrane attachment.

K. Primary Membrane Cleaner: Shall be a high quality solvent cleaner provided by membrane manufacturer and approved by engineer for use as a general membrane cleaner.

L. Pre-weld Cleaner: Shall be a high quality solvent based seam cleaner with moderate evaporation rate provided by membrane manufacturer.

M. Polymer (PVC) Clad Metal:

1. Polymer Clad Metal – Heat-weldable, 24 gauge, AISI G90 galvanized steel sheet with a 20-mil unsupported thermoplastic membrane coating to match the flashing membrane composition laminated on one side. Polymer-Clad metal shall be manufactured by, and included in the warranty of, the single-ply membrane Manufacturer.
2. Color of Polymer (PVC) Clad Metal shall be a custom color and shall be selected by Architect.
3. Locations include, but not limited to, the following:

a. Gravel edge
b. Base Flashing Closure

N. Liquid Flashing:

1. At areas where pre-formed pipe/penetration is complex, provide roof membrane manufacturer' s fully warranted and system compatible two –component PMMA, fleece reinforced liquid flashing membrane system:
a. Overall thickness: 115 mils thick (cured)
b. Color: White
c. Liquid Flashing Primer

2.4 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by PVC membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

C. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated or unless otherwise noted at 1/2" per foot slope.

D. Provide tapered insulation at 1/8" per foot at Roof Systems RS-01 and RS-02.

2.5 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

C. Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

D. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

2.6 COVER BOARD:

A. Manufacturer’s ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch thick, factory primed.

2.7 FLEXIBLE MATT WALKWAYS

A. Flexible Matt Walkways: Factory-formed, 36” min. wide x 32.8 min. feet per roll, nonporous, polyester reinforced, weldable PVC membrane, with slip-resisting, surface-textured, approximately .080” thick, and acceptable to membrane roofing system manufacturer.
   1. Sika-Sarnfil: Sika Plan Walkway-20
   2. Carlisle: Sure-Flex PVC Walkway Roll
   3. Flex: Flexible Matt Walkways meeting the above requirements

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:

   1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.

   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

   3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."

   4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.

   5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

6. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

D. Preparation of Lightweight Concrete (Roof System RS-01 and RS-03):

1. Concrete surfaces must be clean, smooth, sound, fully dry, and free of loose materials, debris or contaminants such as water, moisture, frost, ice, oil and grease that would interfere with proper adhesion and compromise the performance of the product.

2. Prepare concrete surfaces to achieve a Concrete Surface Profile CSP 3 to CSP 5 in accordance with the International Concrete Repair Institute (ICRI) Technical Guideline No. 310.2R-2013.

3.3 SUBSTRATE BOARD

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

1. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.

2. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

3.4 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each

succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

1. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

G. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:

1. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m) and allow primer to dry.

2. Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.

3. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

4. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.5 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.

1. Install sheet according to ASTM D 5036.

B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.

E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.

F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.

2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.

3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

H. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

3.6 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars].

3.7 FLEXIBLE WALKWAY MATT INSTALLATION

A. Flexible Walkway Matts: Install walkway products in locations indicated. Adhere to membrane and heat weld perimeters to roof membrane in accordance with manufacturer’s written instructions.
1. Provide min. of 1” gap between maximum installed lengths of 10’ feet.
2. Do not install over seams in roof membrane. At roof membrane seams, leave 3” gap both sides of seam.

3.8 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction

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ROOFING INSTALLER'S WARRANTY

WHEREAS Insert Installer Company Name of Insert Address herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

Owner: _____

<Insert name of Owner>.

_____

Address: <Insert address>.

_____

Building Name/Type: <Insert information>.

_____

Address: <Insert address>.

_____

Area of Work: <Insert information>.

Acceptance Date: The _____ day of _____, _____ <Insert date year>.

Warranty Period: 60 Months<Insert time>.

Expiration Date: The _____day of _____, <Insert date/year>.

<Insert date>.

AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

    a. Lightning;

    b. Peak gust wind speed exceeding <Insert wind speed> mph (m/sec);

    c. Fire;

    d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;

    e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;

    f. Vapor condensation on bottom of roofing; and

    g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.

3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.

4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall

become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.

7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.

Authorized Signature: <Insert signature>.

Name: <Insert name>.

Title: <Insert title>.

END OF SECTION 07 54 19

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Low-Slope Roof Sheet Metal Fabrications

B. Related Sections:

1. Division 07 Section "Roof Specialties" for manufactured roof specialties not part of sheet metal flashing and trim.
2. Division 07 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.3 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:

1. Identification of material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

PART 2 - PRODUCTS

2.1 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof-Drain Flashing: Fabricate from the following materials:
   1. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch (0.38 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.

   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

END OF SECTION 07 62 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Copings.

B. Related Sections:

1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 07 Section "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
3. Division 07 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
4. Division 07 Section "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. FM Approvals' Listing: Manufacture and install copings roof-edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.

C. SPRI Wind Design Standard: Manufacture and install copings roof-edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:

1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:

1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
3. Details of termination points and assemblies, including fixed points.
4. Details of special conditions.

C. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for copings and roof-edge flashings.

E. Maintenance Data: For roofing specialties to include in maintenance manuals.

F. Warranty: Sample of special warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

1.6 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXPOSED METALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

1. Surface: Smooth, flat finish.
2. Exposed Coil-Coated Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Two-Coat Fluoropolymer: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

1. Exposed High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Two-Coat Fluoropolymer: AAMA 2604. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

2.2 CONCEALED METALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
4. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 COPINGS

A. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet, concealed anchorage, end cap units, and concealed splice plates with same finish as coping caps.

1. Coping-Cap Material: Aluminum, minimum 0.063 inch thick.

   a. Finish: Two-coat fluoropolymer.
   b. Color: As selected by Architect from manufacturer's full range.

2. Corners: Factory mitered and continuously welded. Mitered corners relying on sealant will not be approved. Back leg of welded mitered coping may be fastened with seal –type fasteners.
3. Special Custom Fabrications: Pre-fabricated, Curved (radial) Sections at existing “North” elevation parapet.
4. Coping-Cap Attachment Method: Snap-on, fabricated from coping-cap material.
5. Snap-on-Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches (300 mm) wide, with integral cleats.
6. Face Leg Cleats: Concealed, continuous galvanized-steel.
7. Face Trim Extensions: Separate, vertical aluminum flat trim with angled drip edge of same coping material to cover existing cement board fascia panels.
8. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.
6. Do not disturb existing cement board panels in any fashion whatsoever.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of [uncoated aluminum] [and] [stainless-steel] roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet self-adhering, high-temperature sheet underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise shown on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints with elastomeric sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

3.3 COPING INSTALLATION

A. Install separate face trim extensions, located behind cleats, to adequately cover existing cement board. Do not disturb existing cement board in any fashion whatsoever.

B. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

C. Anchor copings to meet performance requirements.

1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements.
2. For welded mitered corners and curved (radiused coping sections) Interlock face leg drip edge into continuous cleat anchored to substrate at manufacturer's required spacing that meets performance requirements. Anchor back leg of coping with screw fasteners and elastomeric washers at manufacturer's required spacing that meets performance requirements.

3.4 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 71 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Roof Curbs
2. Heavy Load Roof Curbs
3. Roof Equipment Curbs

B. Related Sections:

1. Division 07 Section "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, and miscellaneous sheet metal trim and accessories.
2. Division 07 Section "Roof Specialties" for manufactured copings.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.4 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Required clearances.

D. Warranty: Sample of warranty.

1.5 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.6 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace roof accessories

PART 2 - PRODUCTS

2.1 HEAVY LOAD ROOF CURBS

A. Heavy Load Roof Curbs (RTU-1A and existing RTU units to remain): Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded and sealed corner joints, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Greenheck; GPFHL with capped 2 x 4 nailer
    b. The Pate Company; PC-2 with capped 2 x 4 nailer
    c. Thybar; TEMS-3 with capped 2 x 4 nailer
    d. Or an Approved Comparable product.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Height: Fabricate curbs to minimum height of 10 inches above top roofing surface unless otherwise indicated.

D. Supported Load Capacity: Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported and for existing Roof Top RTU units to be temporarily off loaded from roof and reinstalled on new roof curbs.

E. Material: Zinc-coated (G-90 galvanized) steel sheet, 0.079 inch thick.

F. Construction:

1. Insulation: Factory insulated with 1-1/2-inch-glass-fiber board insulation.
2. Liner: Same material as curb, of manufacturer's standard thickness and finish.
3. Reinforced sides.
4. Factory-installed wood nailer at top of curb, continuous around curb perimeter.
5. Platform Cap (Counterflashing): Full length of curb fabricated from Zinc-coated (galvanized) steel sheet, 0.079 inch thick with same finish to match curb.

6. Fabricate curbs to minimum height of 10 inches above top roofing surface unless otherwise indicated.
7. Flashing flange: 5“ wide
8. Fully Welded Corners

2.2 ROOF CURBS (FANS and EXISTING ROOF TOP FANS)

A. Roof Curbs for Fans: Roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded and sealed corner joints, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Greenheck; GPF with capped 2 x 4 nailer
   b. The Pate Company; PC-2 with capped 2 x 4 nailer
   c. Thybar; TEMS-3 with capped 2 x 4 nailer
   d. Or an Approved Comparable product.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Height: Fabricate curbs to minimum height of 10 inches above top roofing surface unless otherwise indicated.

D. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported and for existing Roof Top fans to be temporarily off loaded from roof and reinstalled on new roof curbs.

E. Material: Zinc-coated (G-90 galvanized) steel sheet, 0.079 inch thick.

F. Construction:

1. Insulation: Factory insulated with 1-1/2-inch-glass-fiber board insulation.
2. Liner: Same material as curb, of manufacturer's standard thickness and finish.
3. Factory-installed wood nailer at top of curb, continuous around curb perimeter.
4. Platform Cap (Counterflashing): Full length of curb fabricated from Zinc-coated (galvanized) steel sheet, 0.079 inch thick with same finish to match curb.
5. Fabricate curbs to minimum height of 10 inches above top roofing surface unless otherwise indicated.
6. Flashing flange: 2-3” wide
7. Fully Welded Corners.

2.3 EQUIPMENT SUPPORTS

A. Equipment Supports: Rail-type metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints**,** and integrally formed structure-mounting flange at bottom.

1. Subject to conformance with the requirements, provide rail-type equipment support as manufactured by one of the following:

a. Greenheck; GESI with capped 2 x 4 nailer
b. The Pate Company; ES-2 with capped 2 x 4 nailer
c. Thybar; TEMS-3 with capped 2 x 4 nailer
d. Or an approved equal.

B. Length: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Height: Fabricate equipment supports to minimum height of 10 inches above top roofing surface unless otherwise indicated.

D. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported.

E. Steel: Zinc-coated (G90 galvanized) steel sheet, 0.079 inch thick.

F. Finish: Acceptable to Roof Membrane Manufacturer for primer/ base flashing.

G. Construction:

1. Curb Profile: Straight side compatible with roofing system.
2. Nailer: Factory-installed continuous wood nailers 3-1/2 inches (wide) on top flange of equipment supports.
3. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb of size and spacing required to meet wind uplift requirements.
4. Platform Cap (Counterflashing): Full length of curb fabricated from Zinc-coated (galvanized) steel sheet, 0.079 inch thick with same finish to match curb.
5. Fabricate equipment supports to minimum height of 10 inches above top roofing surface unless otherwise indicated.
6. All welded construction.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of [uncoated aluminum] [stainless-steel] roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof Curb Installation: Install each roof curb so top surface is level. Attach to steel roof deck in accordance to manufacturer’s written instructions for equipment loads (dead and live loads)

D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other. Attach to steel roof deck in accordance to manufacturer’s written instructions for equipment loads (dead and live loads)

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Division 09 painting Sections.

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 72 00

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.
4. Acoustical joint sealants.

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each application indicated below:

    a. Each kind of sealant and joint substrate indicated.

3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.

    a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

C. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

D. Field-Adhesion Test Reports: For each sealant application tested.

E. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

D. Pre-installation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two (2) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Building Systems; Omniseal 50.
b. Dow Corning Corporation; 995.
c. Pecora Corporation; 898.
d. Polymeric Systems, Inc.; PSI-641.
e. Sika Corporation, Construction Products Division; SikaSil-C995.
f. Tremco Incorporated; Spectrem 2.

2.3 URETHANE JOINT SEALANTS

A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Building Systems; Sonolastic NP1.
b. Pecora Corporation; Dynatrol I-XL.
c. Sika Corporation, Construction Products Division; Sikaflex - 1a.
d. Tremco Incorporated; Dymonic.

B. Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920. Type S, Grade NS, Class 25, for Use T.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Building Systems; Sonolastic NP1.
b. May National Associates, Inc.; Bondaflex PUR 40 FC.
c. Pacific Polymers International, Inc.; Elasto-Thane 230 Type II.
d. Sika Corporation, Construction Products Division; Sikaflex - 1a.
e. Tremco Incorporated; Vulkem 116.

C. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Building Systems; Sonolastic NP 2.
b. .
c. Pecora Corporation; Dynatred.
d. Sika Corporation, Construction Products Division; Sikaflex - 2c NSTremco Incorporated; Vulkem 227.

2.4 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Building Systems; Sonolac.
b. Bostik, Inc.; Chem-Calk 600.
c. Pecora Corporation; AC-20+.
d. Tremco Incorporated; Tremflex 834.
e. Tremco Incorporated; Tremco Butyl Sealant.

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, provide one of the following

    a. Pecora Corporation; AC-20 FTR.
    b. USG Corporation; SHEETROCK Acoustical Sealant.
    c. Tremco

2.6 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) Type O (open-cell material) Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning

operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

a. Concrete.
b. Masonry.
c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

a. Metal.
b. Glass.
c. Porcelain enamel.
d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

    a. Perform 5 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

    a. Whether sealants filled joint cavities and are free of voids.
    b. Whether sealant dimensions and configurations comply with specified requirements.
    c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Field quality control reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Ceco Door; ASSA ABLOY.
2. Curries Company; ASSA ABLOY.
3. DCI Hollow Metal.
4. Mesker Door Inc.

5. Republic Doors and Frames.
6. Steelcraft; an Allegion brand.

2.2 PERFORMANCE REQUIREMENTS

A. Thermally Rated Door Assemblies: Provide exterior hollow metal door assemblies with U-factor of not more than 0.40 deg Btu/F x h x sq. ft. when tested according to ASTM C518.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A.

1. Doors:

   a. Type: As indicated in the Door and Frame Schedule.
   b. Thickness: 1-3/4 inches.
   c. Face: Uncoated steel sheet, minimum thickness of 0.053 inch.
   d. Edge Construction: Model 2, Seamless.
   e. Core: Manufacturer's standard.

2. Frames:

   a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
   b. Construction: Full profile welded.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A.

1. Doors:

   a. Type: As indicated in the Door and Frame Schedule.
   b. Thickness: 1-3/4 inches.
   c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
   d. Edge Construction: Model 2, Seamless.
   e. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
   f. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
   g. Core: Polyisocyanurate.

2. Frames:

   a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
   b. Construction: Full profile welded.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.6 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

2.7 FABRICATION

A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

2.8 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
2. At interior surfaces of jambs and heads of Exterior Door Frames, provide manufacturer’s corrosion resisting coating to prevent corrosion from grout.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

    a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    b. Install frames with removable stops located on secure side of opening.

2. Floor Anchors: Secure with post-installed expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Solidly pack mineral-fiber insulation inside frames.
4. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

B. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.

3.3 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 11 13

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.

1.3 SUBMITTALS

A. Product Data: For each type of door indicated.

B. Shop Drawings Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Indicate dimensions and locations of mortises and holes for hardware.
3. Indicate dimensions and locations of cutouts.
4. Indicate requirements for veneer matching.
5. Clearances and undercuts.
6. Indicate doors to be factory finished and finish requirements.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors from single manufacturer.

B. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

C. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

D. Pre-installation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
   b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Exterior Doors: [Two] [Five] <Insert number> years from date of Substantial Completion.
4. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Algoma Hardwoods, Inc.
2. Buell Door Company Inc.
3. Chappell Door Co.
4. Eggers Industries.
5. Graham; an Assa Abloy Group company.
6. Marshfield Door Systems, Inc.
7. Mohawk Flush Doors, Inc.; a Masonite company.
8. Or an Approved Equal.

2.2 DOOR CONSTRUCTION, GENERAL

A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

B. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-1, made with binder containing no urea-formaldehyde resin.

2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.

2.3 VENEERED-FACED DOORS FOR STAIN FINISH

A. Interior Solid-Core Doors :

1. Grade: Premium, with Grade AA faces.
2. Species: Select white birch.
3. Cut: Rotary cut.
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Balance match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
8. Exposed Vertical and Top Edges: Same species as faces.
9. Core: Particleboard.
10. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.
11. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

2.4 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

B. Transparent Finish

1. Grade: Premium.
2. Finish: AWI TR-4 conversion varnish or TR-6 catalyzed polyurethane system.
3. Staining: As selected by Architect from manufacturer's full range to match existing doors.
4. Effect: Semi-filled finish, produced by applying an additional finish coat to partially fill the wood pores.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.

2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
3. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

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SECTION 08 33 23 – OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Insulated, Heavy-duty, Overhead Coiling Service Door.

1.2 RELATED SECTIONS

A. Section 05 12 00 – Structural Steel Framing: For framed opening.

1.3 REFERENCES

A. ANSI/DASMA 108 - American National Standards Institute Standard Method for Testing Sectional Garage Doors and Rolling Doors: Determination of Structural Performance under Uniform Static Air Pressure Difference.

B. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Element.

C. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

D. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

F. NEMA MG 1 - Motors and Generators.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Details of construction and fabrication.
4. Installation instructions.

C. Shop Drawings: Include detailed plans, elevations, and details of framing members, anchoring methods, required clearances, hardware, and accessories. Include relationship with adjacent construction.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) long, representing actual product, color, and patterns.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

G. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years' experience in the fabrication and installation of security closures.

B. Installer Qualifications: Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

C. Store materials in a dry, warm, ventilated weathertight location.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 COORDINATION

A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

1.10 WARRANTY

A. Warranty: Manufacturer's limited door and operator system, except the counterbalance spring and finish, to be free from defects in materials and workmanship for 3 years or 20,000 cycles, whichever occurs first.

B. Warranties:

1. Manufacturer's limited door system warranty for 2 years for all parts and components.
2. Finish Warranty: Minimum 4 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the requirements provide Stormtite Model #625 Insulated, Heavy-Duty Overhead Coiling Door as manufactured by Overhead Door Corporation or a comparable Insulated, Heavy-Duty Overhead Coiling Door by one of the following:

1. Cornell
2. Raynor
3. Or an approved equal.

2.2 INSULATED ROLLING SERVICE DOORS

A. Insulated Rolling Service Doors:

1. Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.

    a. Slat Profile: Flat insulated type.
    b. Front slat fabricated of
        1) 24 gauge galvanized steel.
    c. Back slat fabricated of:
        1) 24 gauge galvanized steel.
    d. Slat cavity filled with CFC-free foamed-in-place, polyurethane insulation.
        1) Minimum R-Value: 7.7, U-Value: 0.13.

2. Performance:

    a. U-factor: 0.91 NFRC test report, maximum U-factor of no higher than 1.00.
    b. Air Infiltration: Meets ASHRAE 90.1 & IECC 2012/2015 C402.4.3 Air leakage <1.00 cfm/ft2.

3. Slats and Hood Finish:

    a. Galvanized Steel: Slats and hood galvanized in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester powder coat top coat.

        1) Manufacturer’s premium Powder Finish Coat:
            (a) Color to be selected from manufacturer’s full offering of powder coat colors

4. Weatherseals:

    a. Manufacturer’s bottom, exterior curtain side guide and hood baffle meeting ASHRAE 90.1 & IECC 2012/2015 C402.4.3 Air leakage <1.00 cfm/ft2.

5. Bottom Bar:

    a. Two galvanized steel angles minimum thickness 1/8 inch (3 mm) bolted back to back to reinforce curtain in the guides.

6. Guides: Three structural steel angles.
7. Brackets:

    a. Hot rolled prime painted steel to support counterbalance, curtain and hood.

8. Finish; Bottom Bar, Guides, Headplate and Brackets:

    a. Finish: Zinc enriched base coat and Manufacturer's premium powder coat with color as selected by the Architect from manufacturer's full selection of approx. 200 RAL indexed colors.

9. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inch per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
10. Hood: Provide with internal hood baffle weatherseal.

    a. 24 gauge galvanized steel with intermediate supports as required.

11. Manual (Emergency Operation):

    a. Chain hoist.

12. Electric Motor Operation: Provide UL listed electric operator, size as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second.

    a. Sensing Edge Protection:

        1) Wireless, Monitored Edge.

    b. Photocell Monitoring: Provide UL325 Compliant, monitored retro-reflective photocell feature with extended limit.
    c. Operator Controls:

        1) Push-button and key operated control stations with open, close, and stop buttons.
        2) Controls for interior location.
        3) Controls surface mounted.

    d. Motor Electrical: 1 HP, 208V single phase, 60 Hz.

    e. Motor Operator to be equal to Overhead Door Company's RHX , Hoist, 24 VDC Disc-Type with Brake:

        1) Electro-Mechanical Limit Switch Adjustment, Electronic
        2) Control Board W/ LCD Display, On-Board Open/Close/Stop
        3) Functions, Built In Radio Receiver, Cycle Counter,
        4) Maximum Run Timer & Delay On Reverse Feature. Gear
        5) Head Reduction. Thermal Overload Protection System.
        6) Continuous Duty Motor Rated 60 Cycles Per Hour. Nema
        7) 1 Push Button (Open/Close/Stop) Edge Interface
        8) Wireless, Auxiliary Output

13. Wind Load Design:

a. Standard wind load shall be 20 PSF.

14. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles.

15. Locking:

a. Interior slide bolt locks (both sides) with electric interlock switches to prevent operation of motor while engaged.

16. Wall Mounting Condition:

a. Face-of-wall mounting.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify opening sizes, tolerances and conditions are acceptable.

B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of electrical service with electrical. Complete wiring from disconnect to unit components.

F. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 90 00.

G. Install perimeter trim and closures.

H. Instruct Owner’s personnel in proper operating procedures and maintenance schedule.

3.4 ADJUSTING

A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.5 CLEANING

A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.

B. Remove labels and visible markings.

C. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 PROTECTION

A. Protect installed products until completion of project.

3.7 MAINTENANCE

A. Initial Maintenance Service: Beginning at Final Completion, maintenance service shall include twelve 12 months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
B. Perform maintenance, including emergency callback service, during normal working hours.
C. Include 8-hour-per-day, 5-day-per-week, emergency callback service.

END OF SECTION 08 33 23

SECTION 08 80 00 – ALUMINUM FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Exterior storefront framing.

2. Exterior manual-swing entrance doors.

1.3 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
2. Dimensional tolerances of building frame and other adjacent construction.
3. Failure includes the following:

a. Deflection exceeding specified limits.
b. Thermal stresses transferring to building structure.
c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
d. Glazing-to-glazing contact.
e. Noise or vibration created by wind and by thermal and structural movements.
f. Loosening or weakening of fasteners, attachments, and other components.
g. Sealant failure.

B. Structural Loads:

1. Wind Loads: As indicated on Drawings.

C. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is the lessor amount.

D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.

E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of .06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).

F. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

G. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

H. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 60 when tested according to AAMA 1503.

I. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.45 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.

2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
   a. All hardware for doors shall be include in the schedule and indicate the following:
      1) Hardware to be furnished and installed under the requirements of this Section
      2) Hardware to be furnished and installed under the requirements in Section 08 71 00 “Hardware”.
      3) Owner furnished and installed hardware.
   b. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

C. Qualification Data: For qualified Installer.

D. Welding certificates.

E. Preconstruction Test Reports: For sealant.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.

G. Source quality-control reports.

H. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

I. Warranties: Sample of warranty.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

C. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

D. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

F. Pre-installation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures including, but not limited to, excessive deflection.
    b. Noise or vibration caused by thermal movements.
    c. Adhesive or cohesive sealant failures.
    d. Water leakage through fixed glazing and framing areas.
2. Warranty Period: Ten (10) years from date of Substantial Completion.

B. Special Anodized Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

    a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Ten (**10)** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide 403X Series, 2" sightline, Center Set Storefront, dual-pocket thermal barrier, framing system with screw-spline construction as manufactured by Efco Corporationor comparable product by one of the following manufacturers:

1. Kawneer: Series Trifab 451UT
2. YKK AP America: Series YES 45X

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).

3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 EXTERIOR FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken (double thermal barrier) , extruded aluminum components
2. Member Size: 2” sightline x 4-1/2” deep mullion size.
3. Glazing Plane; Centerset
4. Exterior Glazed

B. Provide continuous aluminum sill with turned up leg and fully sealed end dams.

C. Provide Extruded Aluminum, Gasketed Head Receptor where indicated.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 08 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.5 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer of Aluminum storefront’s standard aluminum glazed entrance doors for manual-swing operation.

1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch-(3.2-mm-) thick, extruded-aluminum tubular rail and stile members.

   a. Must be capable of accepting 1” insulated glass units.

2. Exterior Door Design: Wide stile; 5-inch nominal width.

a. Accessible Doors: Bottom Rail: Smooth surfaced for width of door in area within 10 inches (255 mm) above floor or ground plane.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

a. Provide non-removable glazing stops on outside of door.

4. Finish: Match storefront finish

2.6 ENTRANCE DOOR HARDWARE

A. General: For each aluminum entrance door, provide the following entrance door manufacturer's offset pivot hinges, weather stripping, door astragal weather stripping (for pairs of doors), and bottom door sweeps. All other hardware is as specified and furnished/installed by the hardware supplier/installer in Division 08 Section "Door Hardware."

B. Continuous Geared Hinges: Manufacturer standard.
1. Finish: To match door finish.

C. Weather Stripping: Manufacturer's standard replaceable components for each leaf.

1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.

2. Door Astragal Weather Stripping for Meeting Stiles of Pairs of Doors: Weather stripping shall be wool pile and shall be installed in one stile of pairs of doors, secured in place but removable for replacement.

D. Weather Sweeps: Provide Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip for each leaf.

1. Aluminum Finish: To match door finish

2.7 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants."

1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (0.762-mm) thickness per coat.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from exterior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Storefront Framing: Fabricate components for assembly using screw spline joinery (stick).

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. Exterior Storefront:

1. Clear Anodic Finish; AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight unless otherwise indicated.

B. Coordination with Hardware furnished and installed under Section 08 71 00 “Hardware”

1. Coordinate with supplier and installer of hardware to ensure that templates are received and are compatible with entrance doors.

2. Build adequate time in the schedule to receive hardware templates from submitted, review and approved hardware furnished by the Section 08 71 00 hardware supplier.

C. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

D. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

E. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

F. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
2. Alignment:

    a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
    b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.4 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

B. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches (75 mm) from the latch, measured to the leading door edge.

END OF SECTION 08 41 13

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PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components
3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 Section “Alternates” for Owner Preferred Brand Hardware.
2. Division 06 Section “Rough Carpentry”
3. Division 06 Section "Finish Carpentry”
4. Division 07 Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:

    a. “Metal Doors and Frames”
    b. “Flush Wood Doors”
    c. “Interior Aluminum Doors and Frames”
    d. "Aluminum-Framed Entrances and Storefronts"

6. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.
7. Division 26 “Electrical” sections for connections to electrical power system and for low-voltage wiring.
8. Division 28 “Electronic Safety and Security” sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL, ULC

1. UL 1784 - Air Leakage Tests of Door Assemblies
2. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature

4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 101 – Life Safety Code

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:

a. Comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.
b. Review drawings and Sections from related trades to verify compatibility with specified hardware.
c. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:

a. Wiring Diagrams: For power, signal, and control wiring and including:
1) Details of interface of electrified door hardware and building safety and security systems.
2) Schematic diagram of systems that interface with electrified door hardware.
3) Point-to-point wiring.
4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.

a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule:

a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
c. Indicate complete designations of each item required for each opening, include:
    1) Door Index: door number, heading number, and Architect's hardware set number.
    2) Quantity, type, style, function, size, and finish of each hardware item.
    3) Name and manufacturer of each item.
    4) Fastenings and other pertinent information.
    5) Location of each hardware set cross-referenced to indications on Drawings.
    6) Explanation of all abbreviations, symbols, and codes contained in schedule.
    7) Mounting locations for hardware.
    8) Door and frame sizes and materials.
    9) Degree of door swing and handing.
    10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

C. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:

    a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
    b. Include warranties for specified door hardware.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:

    a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
    b. Catalog pages for each product.
    c. Final approved hardware schedule edited to reflect conditions as installed.
    d. Final keying schedule
    e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
    f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:

    a. required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person 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 and meets these requirements:

    a. For door hardware: DHI certified AHC or DHC.
    b. Can provide installation and technical data to Architect and other related subcontractors.
    c. Can inspect and verify components are in working order upon completion of installation.
    d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.

4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Electrified Door Hardware

    a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

2. Accessibility Requirements:

    a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Pre-installation Conference

    a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
    b. Inspect and discuss preparatory work performed by other trades.
    c. Inspect and discuss electrical roughing-in for electrified door hardware.
    d. Review sequence of operation for each type of electrified door hardware.
    e. Review required testing, inspecting, and certifying procedures.
    f. Review questions or concerns related to proper installation and adjustment of door hardware.

2. Electrified Hardware Coordination Conference:

a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.

C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

1.06 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. 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. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

D. Existing Openings: Where existing doors, frames and/or hardware are to remain, field verify existing functions, conditions and preparations and coordinate to suit opening conditions and to provide proper door operation.

1.07 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.

1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.

a. Mechanical Warranty
1) Locks
a) 10 years

2) Exit Devices
   a) 3 years
3) Closers
   a) 30 years

b. Electrical Warranty
1) Locks
   a) 1 year
2) Exit Devices
   a) 1 year

1.08 MAINTENANCE

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approval of alternate manufacturers and/or products other than those listed as “Scheduled Manufacturer” or “Acceptable Manufacturers” in the individual article for the product category are only to be considered by official substitution request in accordance in section 01 25 00.

B. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fabrication

1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer’s recognized installation standards for application intended.
2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with “Metal Doors and Frames”, “Flush Wood Doors”, “Stile and Rail Wood Doors” to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.

B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

C. Cable and Connectors:

1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Ives 5BB series

2. Acceptable Manufacturers and Products:

a. Hager BB1191/1279 series
b. Best FBB series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. Provide hinge weights and sizes as specified in hardware sets.
4. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
6. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

a. Steel Hinges: Steel pins
b. Non-Ferrous Hinges: Stainless steel pins
c. Out-Swinging Exterior Doors: Non-removable pins
d. Out-Swinging Interior Lockable Doors: Non-removable pins
e. Interior Non-lockable Doors: Non-rising pins

7. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 CONTINUOUS HINGES

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

    a. Select
    b. ABH

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

1. Scheduled Manufacturer and Product:

    a. Von Duprin EPT-10

2. Acceptable Manufacturers and Products:

    a. ABH PT1000
    b. Security Door Controls PTM

B. Requirements:

1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer’s template and UL requirements, unless interference with operation of door or other hardware items.

2.06 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. Best 9K series (Owner Preferred Brand Alternate)

2. Acceptable Manufacturers and Products:

    a. Schlage ND series

b. Sargent 11-Line

B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1
2. Provide locks with standard 2-3/4 inches backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
3. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
4. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
5. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
6. Provide electrified options as scheduled in the hardware sets.
7. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.

a. Lever Design: Best 9K series equivalent to Schlage ND Series Sparta (SPA).

2.07 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Von Duprin 98/35A series

2. Acceptable Manufacturers and Products:

a. Detex Advantex series
b. Precision APEX 2000 series

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide smooth touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
7. Provide flush end caps for exit devices.
8. Provide exit devices with manufacturer’s approved strikes.
9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
11. Provide cylinder dogging as specified at non fire-rated openings.
12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
13. Provide electrified options as scheduled.
14. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

15. Special Options:

    a. Provide dogging indicators for visible indication of dogging status.

2.08 POWER SUPPLIES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. Schlage/Von Duprin PS900 Series

2. Acceptable Manufacturers and Products:

    a. Dynalock 5000 series
    b. Security Door Controls 600 series

B. Requirements:

1. Provide power supplies approved by manufacturer of supplied electrified hardware.
2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Provide power supplies with the following features:

    a. 12/24 VDC Output, field selectable.
    b. Class 2 Rated power limited output.
    c. Universal 120-240 VAC input.
    d. Low voltage DC, regulated and filtered.
    e. Polarized connector for distribution boards.
    f. Fused primary input.
    g. AC input and DC output monitoring circuit w/LED indicators.
    h. Cover mounted AC Input indication.
    i. Tested and certified to meet UL294.
    j. NEMA 1 enclosure.
    k. Hinged cover w/lock down screws.
    l. High voltage protective cover.

2.09 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer and Product:

    a. Best Small format interchangeable temporary core (SFIC) by Contractor.

B. Requirements:

1. Provide cylinders for locking devices, whether called out in hardware sets or not.
2. Provide temporary cores to match Owner's existing Best key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated.

2.10 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

   a. LCN 4040XP series

2. Acceptable Manufacturers and Products:

   a. Corbin-Russwin DC8000 series
   b. Sargent 281 series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.11 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:

   a. Ives.

2. Acceptable Manufacturers:

   a. Trimco
   b. Burns

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.12 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Burns
b. Trimco

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Provide protection plates with countersunk screw holes.
3. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.

2.13 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:

a. Glynn-Johnson

2. Acceptable Manufacturers:

a. Rixson
b. ABH

B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.
2. Provide friction type at doors without closer and positive type at doors with closer.

2.14 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Trimco
b. Burns

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.15 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer:

a. Zero International

2. Acceptable Manufacturers:

a. National Guard
b. Reese

B. Requirements:

1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
2. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
3. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.16 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Steelcraft
b. Republic

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.17 DOOR POSITION SWITCHES

A. Manufacturers:

1. Scheduled Manufacturer:

a. Schlage

2. Acceptable Manufacturers:

a. GE-Interlogix
b. Sentrol

B. Requirements:

1. Provide recessed or surface mounted type door position switches as specified.
2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches (102 mm) between switch and magnetic locking device.

2.18 LATCH PROTECTORS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Burns
b. Trimco

B. Provide stainless steel latch protectors of type required to function with specified lock.

2.19 COAT HOOKS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Burns
b. Trimco

B. Provide coat hooks as specified.

2.20 FINISHES

A. Finish: Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.

B. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

D. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Where on-site modification of doors and frames is required:

1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
2. Field modify and prepare existing doors and frames for new hardware being installed.
3. When modifications are exposed to view, use concealed fasteners, when possible.
4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:

    a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
    b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
    c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.03 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
4. Installation Guide for Doors and Hardware: DHI TDH-007-20

B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.

C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

I. Lock Cylinders:

1. Install temporary construction cores to secure building and areas during construction period.
2. Owner will replace temporary construction cores with permanent core.

J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.
4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
5. Connections to panel interface modules, controllers, and gateways.
6. Testing and labeling wires with Architect's opening number.

K. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

L. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.

M. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

N. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

O. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

P. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

Q. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.05 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer’s instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.06 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier’s responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

D. Hardware Sets:

HARDWARE GROUP NO. 01

Provide each RU door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
		NOTE	HARDWARE BY DOOR SUPPLIER		

HARDWARE GROUP NO. 02

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	BEST EQUIV. TO SCHLAGE ND50BDC SPA	626	BES
1	EA	PERM. CYLINDER CORE	BY OWNER	626	BES
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 03

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	BEST EQUIV. TO SCHLAGE ND70BDC SPA	626	BES
1	EA	PERM. CYLINDER CORE	BY OWNER	626	BES
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 04

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	BEST EQUIV. TO SCHLAGE ND70BDC SPA	626	BES
1	EA	PERM. CYLINDER CORE	BY OWNER	626	BES
1	EA	OH STOP	90S	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 05

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	BEST EQUIV. TO SCHLAGE ND80BDC SPA	626	BES
1	EA	PERM. CYLINDER CORE	BY OWNER	626	BES
1	EA	OH STOP	90S	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 06

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	BEST EQUIV. TO SCHLAGE ND40S SPA	626	BES
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	SINGLE HOOK	507B	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 07

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	BEST EQUIV. TO SCHLAGE ND70BDC SPA	626	BES
1	EA	PERM. CYLINDER CORE	BY OWNER	626	BES
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 08

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	PANIC HARDWARE	CDSI-98-NL	626	VON
1	EA	SFIC MORTISE CYL.	BEST EQUIV. TO SCHLAGE 80-110	626	BES
1	EA	SFIC RIM CYLINDER	BEST EQUIV. TO SCHLAGE 80-116	626	BES
2	EA	PERM. CYLINDER CORE	BY OWNER	626	BES
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 09

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	PANIC HARDWARE	CDSI-9849-DT-LBL	626	VON
1	EA	PANIC HARDWARE	CDSI-9849-NL-LBL	626	VON
2	EA	SFIC MORTISE CYL.	BEST EQUIV. TO SCHLAGE 80-110	626	BES
1	EA	SFIC RIM CYLINDER	BEST EQUIV. TO SCHLAGE 80-116	626	BES
3	EA	PERM. CYLINDER CORE	BY OWNER	626	BES
2	EA	SURFACE CLOSER	4040XP EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CVX	630	IVE
2	SET	MEETING STILE	328AA-S	AA	ZER
1	EA	GASKETING	488SBK PSA	BK	ZER

HARDWARE GROUP NO. 10

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 6" X 16"	630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"	630	IVE
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

OPERATIONAL DESCRIPTION: DOORS NORMALLY CLOSED AND UNLOCKED. PUSH/PULL OPERATION.

HARDWARE GROUP NO. 11

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ELECTRIC HINGE	5BB1 4.5 X 4.5 CON TW8	652	IVE
1	EA	EU STOREROOM LOCK	BEST EQUIV. TO SCHLAGE ND80BDCEU SPA RX CON 12V/24V DC	626	BES
1	EA	PERM. CYLINDER CORE	BY OWNER	626	BES
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	WIRE HARNESS	CON-6W		SCH
1	EA	WIRE HARNESS	CON-XX-P LENGTH AS REQUIRED FOR USE WITH DOOR		SCH
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS902 BBK KL900 120/240 VAC	LGR	SCE
1	SET	WIRING DIAGRAMS	DOOR ELEVATION AND POINT-TO-POINT		SCE
			CARD READER BY OTHERS		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. ACCESS BY KEY, OR VALID CREDENTIAL, WHICH SHUNTS DOOR POSITION SWITCH AND MOMENTARILY UNLOCKS OUTSIDE LEVER. INSIDE LEVER ALWAYS FREE FOR EGRESS. OPERATING INSIDE LEVER SHUNTS DOOR POSITION SWITCH FOR REQUEST TO EXIT (REX).

HARDWARE GROUP NO. 12

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	ELECTRIC HINGE	5BB1 4.5 X 4.5 CON TW8	630	IVE
1	EA	EU STOREROOM LOCK	BEST EQUIV. TO SCHLAGE ND80BDCEU SPA RX CON 12V/24V DC	626	BES
1	EA	PERM. CYLINDER CORE	BY OWNER	626	BES
1	EA	LOCK GUARD	LG1	630	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH WMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-223	A	ZER
1	EA	WIRE HARNESS	CON-6W		SCH
1	EA	WIRE HARNESS	CON-XX-P LENGTH AS REQUIRED FOR USE WITH DOOR		SCH
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS902 BBK KL900 120/240 VAC	LGR	SCE
1	SET	WIRING DIAGRAMS	DOOR ELEVATION AND POINT-TO-POINT		SCE
			CARD READER BY OTHERS		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. ACCESS BY KEY, OR VALID CREDENTIAL, WHICH SHUNTS DOOR POSITION SWITCH AND MOMENTARILY UNLOCKS OUTSIDE LEVER. INSIDE LEVER ALWAYS FREE FOR EGRESS. OPERATING INSIDE LEVER SHUNTS DOOR POSITION SWITCH FOR REQUEST TO EXIT (REX).

HARDWARE GROUP NO. 13

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	224XY EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	ELEC PANIC HARDWARE	RX-LC-QEL-98-EO-CON 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	RX-LC-QEL-98-NL-OP-110MD-CON 24 VDC	626	VON
1	EA	SFIC MORTISE CYL.	BEST EQUIV. TO SCHLAGE 80-110	626	SCH
1	EA	SFIC RIM CYLINDER	BEST EQUIV. TO SCHLAGE 80-116	626	SCH
2	EA	PERM. CYLINDER CORE	BY OWNER	626	BES
2	EA	90 DEG OFFSET PULL	8190EZHD 10" O	630-316	IVE
2	EA	OH STOP	100S	630	GLY
2	EA	SURFACE CLOSER	4040XP EDA	689	LCN
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-223	A	ZER
1	EA	WIRE HARNESS	CON-6W		SCH
2	EA	WIRE HARNESS	CON-XX-P LENGTH AS REQUIRED FOR USE WITH DOOR		SCH
2	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS902 BBK 900-4RL KL900 120/240 VAC	LGR	SCE
1	SET	WIRING DIAGRAMS	DOOR ELEVATION AND POINT-TO-POINT		SCE
			CARD READER BY OTHERS		
			SEALS BY DOOR SUPPLIER		

OPERATIONAL DESCRIPTION: DURING BUSINESS HOURS, DOORS ARE CLOSED AND UNLOCKED (EXIT DEVICES ELECTRICALLY DOGGED). FREE ACCESS AND EGRESS WITH PUSH/PULL OPERATION. AFTER HOURS, DOORS AND CLOSED AND LOCKED. AUTHORIZED ACCESS BY KEY OR VALID CREDENTIAL, WHICH SHUNTS DOOR POSITION SWITCHES, AND MOMENTARILY UNLATCHES RHR DOOR, ALLOWING DOOR TO BE PULLED OPEN. IMMEDIATE EGRESS ALWAYS ALLOWED. INSIDE PUSH RAILS SHUNT DOOR POSITION SWITCHES FOR REQUEST TO EXIT (REX).

HARDWARE GROUP NO. 14

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	RX-LC-QEL-98-NL-CON 24 VDC	626	VON
1	EA	SFIC RIM CYLINDER	BEST EQUIV. TO SCHLAGE 80-116	626	BES
1	EA	PERM. CYLINDER CORE	BY OWNER	626	BES
1	EA	SURFACE CLOSER	4040XP SCUSH WMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-223	A	ZER
1	EA	WIRE HARNESS	CON-6W		SCH
1	EA	WIRE HARNESS	CON-XX-P LENGTH AS REQUIRED FOR USE WITH DOOR		SCH
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS902 BBK 900-2RS KL900 120/240 VAC	LGR	SCE
1	SET	WIRING DIAGRAMS	DOOR ELEVATION AND POINT-TO-POINT CARD READER BY OTHERS		SCE

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. ACCESS BY KEY, OR VALID CREDENTIAL, WHICH SHUNTS DOOR POSITION SWITCH AND MOMENTARILY RETRACTS LATCHBOLT. INSIDE ALWAYS FREE FOR EGRESS. OPERATING INSIDE PUSH RAIL SHUNTS DOOR POSITION SWITCH FOR REQUEST TO EXIT (REX).

HARDWARE GROUP NO. 15

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	ELEC PANIC HARDWARE	LD-RX-LC-98-EO-CON	626	VON
1	EA	ELEC PANIC HARDWARE	QEL-98-NL-CON 24 VDC	626	VON
1	EA	SFIC MORTISE CYL.	BEST EQUIV. TO SCHLAGE 80-110	626	BES
1	EA	SFIC RIM CYLINDER	BEST EQUIV. TO SCHLAGE 80-116	626	BES
2	EA	PERM. CYLINDER CORE	BY OWNER	626	BES
2	EA	SURFACE CLOSER	4040XP SHCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
2	SET	MEETING STILE	328AA-S	AA	ZER
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-223	A	ZER
1	EA	WIRE HARNESS	CON-6W		SCH
2	EA	WIRE HARNESS	CON-XX-P LENGTH AS REQUIRED FOR USE WITH DOOR		SCH
2	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS902 BBK 900-2RS KL900 120/240 VAC	LGR	SCE
1	SET	WIRING DIAGRAMS	DOOR ELEVATION AND POINT-TO-POINT		SCE
1			CARD READER BY OTHERS		

OPERATIONAL DESCRIPTION: DOORS NORMALLY AND CLOSED AND LOCKED. AUTHORIZED ACCESS BY KEY OR VALID CREDENTIAL, WHICH SHUNTS DOOR POSITION SWITCHES, AND MOMENTARILY UNLATCHES RHR DOOR, ALLOWING DOOR TO BE PULLED OPEN. IMMEDIATE EGRESS ALWAYS ALLOWED BY DEPRESSING INSIDE PUSH RAILS. INSIDE PUSH RAILS SHUNT DOOR POSITION SWITCHES FOR REQUEST TO EXIT (REX).

END OF SECTION 08 71 00

PART 1 - GENERAL

1.1 GENERAL

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

1.3 SUMMARY

A. Subject to the requirements of the Conditions of the Contract and Division 01 Sections of the Specifications, the Work of this Section includes, but is not limited to:

1. Glazing at Glazed Aluminum Curtainwall Assemblies.
2. Glazing at Aluminum Storefront Systems.
3. Glazing at Aluminum Entrance Doors.
4. Glazing at Interior Door Lites.
5. Glazing at Interior Aluminum Framing.

1.4 RELATED SECTIONS

A. Examine the Drawings and other Sections of the Specifications for work and materials associated with the Work of this Section, including, but not limited to:

1. Division 07; Section “Joint Sealants”.
2. Division 08; Section “Aluminum Framed Entrances and Storefront System”.

1.5 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thicknesses indicated are minimums and are for detailing only.

1. Confirm glass thicknesses by analyzing Project loads and in-service conditions.
2. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
   a. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
   b. Specified Design Wind Loads: As indicated.
3. Probability of Breakage for Vertical Glazing:
   a. 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
   b. Load Duration: 60 seconds or less.
   c. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm.

d. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.

C. Thermal Movements:

1. Provide glazing that allows for thermal movements resulting from a maximum change (range) of 120 deg F, 180 deg F in ambient and surface temperatures, respectively, acting on glass framing members and glazing components.
2. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

D. Performance Values (For Insulated Glass Units)

1.	Visible Light Transmission %:	43
2.	UV Transmission %:	17
3.	Solar Energy Transmission %:	19
4.	Visible Light Out Reflectivity %:	28
5.	Visible Light In Reflectivity %:	14
6.	Solar Energy Reflectivity %:	43
7.	U-Value Winter Nighttime Btu/hr·ft²·F:	0.240
8.	U-Value Summer Daytime Btu/hr·ft²·F:	0.212
9.	Shading Coefficient:	0.25
10.	Solar Heat Gain Coefficient:	0.22
11.	Light-to-Solar Gain:	1.94

1.6 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

1. Include data for structural glazing sealant and accessories for butt-glazed panels, and written instructions and recommendations for installation of butt-glazing system.

B. Glazing Schedule: Use same designations indicated on Drawings.

1.7 QUALITY ASSURANCE

A. Fire-Rated Assemblies: Where glazing products are used in fire-rated assemblies, comply with requirements of specific assembly specified in other sections of these Specifications.
1. Door Assemblies: Complying with NFPA 80 and 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.
2. Window Assemblies: Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to approving authorities, for fire ratings indicated, based on testing according to NFPA 257.

B. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.

C. Glazing Publications: Comply with recommendations of the following, unless more stringent requirements are indicated.
1. GANA Publications: "Glazing Manual."
2. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines."

D. Insulating-Glass Certification Program: Permanently marked with certification label of Insulating Glass Certification Council.

1.8 WARRANTY

Special Warranty: Manufacturer's standard form, made out to Owner and signed by manufacturer, in which manufacturer agrees to furnish replacements for units that deteriorate from normal use by developing defects attributable to the manufacturing process, f.o.b. the nearest shipping point to Project site, within warranty period.

1. Insulating Glass:
   a. Deterioration: Failure of hermetic seal resulting in obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   b. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS MATERIALS

A. Products/Manufacturers: Subject to compliance with the requirements, provide glass and insulated glass assemblies by Guardian or a comparable product in every aspect, including, but not limited to, color, performance, and reflectivity by:

1. PPG
2. Vitro
3. Viracon

B. Heat-Treated Float Glass:

1. ASTM C 1048; class, kind, and condition as indicated in Schedule of Glass Fabrications: a. Type I (transparent glass, flat); Quality q3 (glazing select).
2. Provide Kind FT (fully tempered), float glass.
3. For uncoated glass, comply with requirements for Condition A.
4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
5. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.

C. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units, and with requirements specified in this Article and in the Schedule of Glass Fabrications, herein.

1. Provide Kind FT (fully tempered) where safety glass is indicated.
2. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated in the Schedule of Glass Fabrications are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
3. Sealing System: Dual seal, with polyisobutylene and silicone primary and secondary sealants.
4. Spacer: Aluminum with black color-anodized finish.
5. Dessicant: Molecular sieve or silica gel, or blend of the two.
6. Corner Construction: Manufacturer's standard.

2.2 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tape:

1. Preformed, butyl-based elastomeric tape with a solids content of 100 percent with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated and complying with ASTM C 1281 and AAMA 800 for products indicated.
2. AAMA 806.3 tape.

2.3 GLAZING GASKETS

A. Compression Gaskets: Molded or extruded gaskets of type and material indicated below and of profile and hardness required to maintain watertight seal:

1. Silicone dense compression gaskets complying with ASTM C 1115.
2. EPDM or silicone soft compression gaskets complying with ASTM C 509, Type II, black.

2.4 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.5 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined printed instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm) as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so that they protrude past face of glazing stops.

3.6 SCHEDULE OF GLASS FABRICATIONS

A. Glass Type G-1: Low-e-coated, clear insulating glass; comparable to Guardian SuperNeutral Low-E Glass- SNR43 on Clear

1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 6 mm.
3. Outdoor Lite: Clear, fully tempered float glass.
4. Interspace Content: Argon.
5. Indoor Lite: Clear, fully tempered float glass.
6. Low-E Coating: On second surface (#2).
7. Provide safety glazing labeling.

B. Glass Type G-2 (Spandrel): Similar to G-1 above, except provide opacifying coating on third surface.

1. Color of opacifier coating to be determined by Architect from manufacturer's full range of colors.
2. Use only neutral curing sealants in contact with silicon opacifier coatings.
3. Use only non-neoprene based setting blocks in contact with silicon based opacifier coatings.
4. Opacifying Coating shall be applied in a 5 mil DFT thickness. Cut back coating so as not to interfere with spacer construction of the I.G. Unit.

C. Glass Type G-3 (Interior Glazing in Interior Doors): Clear, fully tempered float glass

1. Thickness: 6 mm.
2. Provide safety glazing labeling

END OF SECTION 08 80 00

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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.

B. Drawings may indicate “Light Gage Metal Framing” (LGMF) for non-structural metal framing, these terms are synonymous.

1.2 SUMMARY

A. This Section includes non-load-bearing steel framing members for the following applications:

1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

B. Related Sections include the following:

1. Division 05 Section "Cold-Formed Metal Framing" for interior and/or exterior non load-bearing metal framing.
2. Division 07 Section "Thermal Insulation" for insulation installed with Z-shaped furring members.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of non-structural steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For non-structural metal framing.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

1.5 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association or the Steel Stud Manufacturers Association.

B. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design non-structural steel framing including, but not limited to, the following:

1. Top of wall framing connections to metal building system's primary and secondary structural roof members
2. Metal Framing Bracing
3. Header Beams- All Locations
4. Horizontal Metal Framing to support suspension system components.
5. Consideration for loads imposed by wall hung items such as millwork overhead cabinets.
6. Consideration for lengths of studs greater than 12'-0"

B. Vertical Deflection: Design top of wall connections of metal framed partitions to allow for +/- vertical movement of metal building system due to live loads such as wind and snow loading.

C. Horizontal Deflection: For composite and non-composite wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft.

1. Take into consideration loads imposed by wall hung items such as millwork.

D. Metal framing that exceeds the height requirements shall be included as part of Section 05 40 00 "Cold Formed Metal Framing"

2.2 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40.

2.3 SUSPENSION SYSTEM COMPONENTS

A. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Armstrong World Industries, Inc.: Drywall Grid Systems
b. Chicago Metallic Corporation: 640-Drywall Furring System.
c. USG Corporation: Drywall Suspension System.
d. Or an Approved comparable product.

2. Provide for seismic design per ACSE-7 seismic requirements for architectural components in accordance with CISCA publications.

B. Grid suspension system shall not be used for perimeter of room gypsum board soffit areas; utilize conventional steel framing assemblies herein.

2.4 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness 0.021875 inch
   a. At door jamb locations, walls with Tile Finishes, walls supporting overhead cabinets and visual display surfaces, utilize .03125 inch studs.
2. Depth: As indicated on Drawings.
3. Spacing: 16” OC max.

B. Slip-Type Head Joints: Provide the following:

1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

   a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   b. Products: Subject to compliance with requirements, provide one of the following:

      1) Steel Network Inc. (The); VertiClip SLDSeries.
      2) Superior Metal Trim; Superior Flex Track System (SFT).
      3) Clark-Dietrich.
      4) Or an Approved comparable product.

C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 00.027 inch.

D. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch wide flanges.

1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch thick, galvanized steel.

E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: 0.021875 inch.
2. Depth: As indicated on Drawings.

F. Cold-Rolled Furring Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch wide flanges.

1. Depth: As indicated on the drawings.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch.

3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch diameter wire.

G. Header Beams:

1. Span all interior openings by floor supported headers and all dead loads above openings shall bear on floor supported header beams. Design height of headers based on span.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof panels
6. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Seismic Bracing: Sway-brace suspension systems with hangers used for support at 12’-0” o.c. each direction

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.

1. Space studs as follows:

a. Single-Layer Application: 16 inches o.c., unless otherwise indicated.
b. Multilayer Application: 16 inches o.c., unless otherwise indicated.
c. Tile backing panels: 16 o.c., unless otherwise indicated.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb, unless otherwise indicated.
b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated. Set runner track in (2) continuous beads of sealant.

D. Direct Furring:

1. Attach to Metal Building System’s horizontal z-girts, with self–tapping metal screws

E. Z-Furring Members:

1. Erect insulation (specified in Division 07 Section "Thermal Insulation") vertically and hold in place with Z-furring members spaced 24 inches o.c.
2. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (300 mm) from corner and cut insulation to fit.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 09 22 16

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. Interior gypsum board.

B. Related Sections include the following:

1. Division 06 Section "Sheathing" for glass mat faced gypsum sheathing.
2. Division 07 Section "Thermal Insulation" for sound attenuation batts installed in assemblies that incorporate gypsum board.
3. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board.
4. Division 09 Section "Tiling" for cement backer units installed as substrates for ceramic tile.
5. Division 09 painting Sections for primers applied to gypsum board surfaces

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.5 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned. Maintain relative humidity below 60% for a period of 72 hours prior to gypsum board installation.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

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

PART 2 - PRODUCTS

2.1 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
1. Manufacturer/Product: Subject to compliance with requirements, provide products by one of the following:
   a. G-P Gypsum.
   b. National Gypsum Company.
   c. USG Corporation.
   d. Or an approved manufacturer/product.

B. Type X:

1. Thickness: 5/8 inch.
2. Long Edges: Tapered

C. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.

1. Thickness: 1/2 inch.
2. Long Edges: Tapered.

D. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board. Use at TBD unless noted otherwise.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.

2.2 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:

   a. Cornerbead.
   b. LC-Bead: J-shaped; exposed long flange receives joint compound.
   c. L-Bead: L-shaped; exposed long flange receives joint compound.

d. Expansion (control) joint.

2.3 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

D. Joint Compound for Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
3. For direct attachment to the exterior Insulated Concrete Forming (ICF) System, use screws as recommended by the ICF manufacturer.

C. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

1. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL

A. Do not install gypsum board until buildings are fully enclosed and conditioned.

3.3 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

3.4 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Type X: Vertical surfaces, unless otherwise indicated.
   2. Ceiling Type: Ceiling surfaces.
   3. Abuse-Resistant Type: As indicated on Drawings and as noted herein.

B. Single-Layer Application:

   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels [vertically (parallel to framing)] [horizontally (perpendicular to framing)], unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

   3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

   1. Level 2: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.

      a. Primer and its application to surfaces are specified in other Division 09 Sections.

3.6 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

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

END OF SECTION 09 29 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Porcelain Tile
2. Porcelain Base Tile
3. Ceramic Tile
4. Crack isolation membranes
5. Cementitious underlayments.
6. Cement Backing Panels
7. Tile Setting and Grouting Beds and Jointings

B. Related Sections:

1. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards, in ANSI A118 series of tile setting and grouting materials, and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PERFORMANCE REQUIREMENTS

A. Dynamic Coefficient of Friction (DCOF): For tile installed on floor , provide products with the following values as determined by testing identical products as measured by performing the DCOF AcuTest in accordance with ANSI A137.1:

1. Level: Minimum 0.42 wet

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Full-size units of each type of trim and accessory for each color and finish required.
3. Stone thresholds in 6-inch lengths.
4. Metal edge strips in 6-inch lengths.

E. Qualification Data: For qualified Installer.

F. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

G. Product Certificates: For each type of product, signed by product manufacturer.

H. Material Test Reports: For each tile-setting and -grouting product.

I. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

J. Samples of Manufacturer Warranties.

K. Sample of Tile Installer Warranty

1.6 QUALITY ASSURANCE

A. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, grout component, and joint sealants from one manufacturer and each aggregate from one source or producer.

B. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:

1. Crack isolation membrane.
2. Waterproof Membrane

C. Pre-installation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

2. The Tile Contractor shall review conditions of all substrates that adjoin tiling systems and shall identify any and all areas where substrate conditions do not meet substrate requirements of ANSI A108.01.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PERFOMANCE REQUIREMENTS

A. Floor Slip Resistance: All Floor Tile shall be tested in accordance with ASTM A137.1 “DCOF Rating Test” (Wet DCOF acutest).

1. Must have a minimum 0.42 “passing” value or higher as noted.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.10 EXTRA MATERIALS (ATTIC STOCK)

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide silicon spot edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

A. Porcelain Floor Tile (PFT-1) and Porcelain Wall Tile (PWT-1): Matte finish, unglazed through body porcelain paver tile.

1. Manufacturer/Product: Subject to compliance with requirements, provide Access Point Porcelain Series; Color: “Ash Concrete” as manufactured by Crossville Tile or a comparable porcelain floor tile as manufactured by one of the following:
   a. Trinity Surfaces: Area Portland –Matte
   b. Surfaces 9 -American Porcelain Collection -City Scape
2. Composition: Through body porcelain.
3. Size: 12” x 24” nominal.
4. Shade Variation: V2
5. DCOF Wet Acutest Rating: No less than 0.50
6. Thickness: Minimum 10.5 mm.
7. Finish: Unpolished

B. Porcelain Wall Base Tile (PWB-1): Matte finish, unglazed through body porcelain bullnose trim units:

1. Manufacturer/Product: Subject to compliance with requirements, provide Access Point Porcelain Series; Color: “Ash Concrete” as manufactured by Crossville Tile or a comparable matte finish, unglazed through body porcelain bullnose trim porcelain floor tile as manufactured by one of the following:
   a. Trinity Surfaces: Area Portland –Matte
   b. Surfaces 9 -American Porcelain Collection -City Scape
2. Size: Minimum 4” x 12”
3. Shade Variation: V2
4. Thickness: Minimum 8mm
5. Surface: Smooth

2.3 CEMENT BACKER PANELS

A. Cement Backer Panels: ANSI A118.9 or ASTM C 1325, in maximum lengths available to minimize end-to-end butt joints.

1. Manufacturer/Product: Subject to compliance with requirements, provide one of the following:

    a. C-Cure; C-Cure Board 990.
    b. Custom Building Products; Wonderboard.
    c. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
    d. USG Corporation; DUROCK Cement Board.
    e. Or an approved comparable manufacturer/product

2. Thickness: 5/8" inch.

3. Location: At metal stud partitions indicated on the drawings

2.4 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product, selected from the following that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.

1. Manufacturer/Product: Subject to compliance with requirements, provide one of the following:

    a. Noble Company (The); Nobleseal CIS.
    b. National Applied Construction Products: ECB Anti Fracture Membrane
    c. MAPEI Corporation: Mapeguard 2.
    d. Or an Approved comparable manufacture/product.

2.5 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
1. Manufacturer/Product: Subject to compliance with requirements, provide Laticrete 254 Platinum or comparable product by one of the following:
    a. C-Cure.
    b. MAPEI Corporation.

2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.6 GROUT

A. Subject to compliance with the requirements, provide Mapei #5014 grout with stain blocker additive as manufactured by Mapei or provide comparable products including, but not limited to, matching in color, by one of the following manufacturer:
1. Custom Building Products
2. Laticrete

B. Use un-sanded grout where tile joints are less than or equal to 1/8”.

C. Use sanded grout where tile joints are more than 1/8”.

2.7 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."

1. Use sealants that have a VOC content of 250g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

1. Products: Subject to compliance with requirements, provide the following
   a. Dow Corning Corporation; Dow Corning 786.
   b. GE Silicones; a division of GE Specialty Materials; Sanitary 1700.
   c. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
   d. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.

2.8 MISCELLANEOUS MATERIALS

A. Trowel Applied Cementitious Leveling Compounds: Water-resistant hydraulic cement based smoothing compound.

1. Manufacturer/Product: Subject to compliance with requirements, provide Ardex S 21 with or comparable products by one of the following:
   a. Con-spec.

B. Termination Strips: At locations where tiling terminates adjacent to a different flooring finish use stainless steel tile termination strip such as “Schiene” as manufactured by Schüter.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.9 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thickset mortar beds, bonded medium set mortar beds, thin-set mortar beds comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowel applied leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

C. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:

    a. Tile floors in wet areas.
    b. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
    c. Tile floors composed of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

E. Joint Widths: Install per joint width requirement of Part 2 of this specification.

F. Construction Joints, Control Joints, and Cracks: Provide crack isolation membrane in strips over joints and cracks. Install per manufacturer’s written instructions.

3.4 TILE BACKING PANEL INSTALLATION

A. Install cementitious backer units and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.5 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.6 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-portland cement grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor.

1. Floor Tile: Thin set latex modified Portland cement on Crack Isolation Membrane
2. Base Tile: Thin set latex modified portland cement on prepared wall surfaces.
3. Grout: As indicated

B. Wall Installation

a. Wall Tile: Thin set latex modified portland cement with anti-sag additive on cementitious backer units.
b. Grout: As indicated.

END OF SECTION 09 30 00

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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:

1. Acoustical Ceiling Panels and exposed suspension systems for acoustical panel ceilings.

1.3 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension system members.
2. Method of attaching hangers to building structure.
3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
4. Minimum Drawing Scale: 1/4 inch = 1 foot.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6-inch Samples of each type, color, pattern, and texture.
2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch long Samples of each type, finish, and color.

D. Qualification Data: For testing agency.

E. Field quality-control test reports.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.

G. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor and fastener type.

H. Maintenance Data: For finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

B. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
2. Suspension System: Obtain each type through the same source providing the Acoustic Ceiling panels.

C. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide acoustical panel ceilings and perforated metal panel ceiling systems that comply with the following requirements:

1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

a. Smoke-Developed Index: 450 or less.

E. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:

1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
2. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
3. ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they

will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.8 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.9 EXTRA MATERIALS (ATTIC STOCK)

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed or 4 full boxes whichever is the greater amount. Provide in sealed boxes with label affixed indicating Product Name, Color, and Type.

2. Perforated Metal Ceiling Panels: Full-size panels with acoustical backing equal to 2.0 percent of quantity installed or a minimum of 5 panels whichever is the greater amount. Provide in sealed boxes with label affixed indicating Product Name, Color, and Type.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

B. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING (APC-1)

A. Subject to compliance with the requirements, provide “Ultima High NRC #1942” acoustical panels manufactured by Armstrong World Industries or a comparable product by one of the following manufacturers:

1. Certainteed (Saint Gobain): Symphony m High NRC #1222BF-80-1
2. USG: Mars High-NRC #87100
3. Or an Approved Equal.

B. Classification for Acoustical Panel Type (APC-1): Wet formed, mineral fiber with acoustically transparent membrane. Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:

1. Type and Form: Type IV, Form 2,
2. Pattern E

C. Color:
1. Type APC-1: White

D. NRC:
1. Type APC-1: NRC: Not less than 0.80.

E. CAC:
1. Type APC-1: Not less than 35.

F. Light Reflectance
1. Type APC-1: Not less than 85%.

G. Edge/Joint Detail:
1. Type APC-1: Narrow 9/16” Beveled Tegular

H. Modular Size:
1. Type APC-1: 24 by 24 inches

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
4. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch diameter wire.

E. Seismic Stabilizer Clips: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILINGS

A. Subject to compliance with requirements, provide “Interlude XL HRC ”9/16” suspension system as manufactured by .Armstrong World Industries or a comparable product by one of the following:
1. Certainteed (Saint Gobain): Narrow Reveal Corner Bevel 9/16” EZ Stab Tier Drop.
2. USG: Identitee DXI

B. Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation.

1. Structural Classification: Intermediate.
2. Face Design: As indicated/
3. Cap Material: Steel cold-rolled sheet.
4. Cap Finish: Painted white.

2.5 METAL EDGE MOLDINGS AND TRIM

A. Products: Metal Edge Moldings and Trim shall be provided by the same manufacture of the metal suspension system for acoustical panel and perforated metal panel ceiling system.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.

2.6 ACOUSTICAL SEALANT

A. Products: Subject to compliance with requirements, provide one of the following:

1. Acoustical Sealant for Exposed and Concealed Joints:

a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
b. USG Corporation; SHEETROCK Acoustical Sealant.
c. Tremco; Tremflex 834

2. Acoustical Sealant for Concealed Joints:

   a. Pecora Corporation; BA-98.
   b. USG Corporation; SHEETROCK Acoustical Sealant.
   c. Tremco, Inc.; Tremco Acoustical Sealant.

B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members (PEMB) primary frames and purlins and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
7. Do not support ceilings directly from roof panels.
8. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post installed anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:
   a. Install panels with pattern running in one direction parallel to short axis of space.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
4. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

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SECTION 09 54 36 - SUSPENDED DECORATIVE GRIDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes rigid, open-frame, suspended grids and suspension systems for ceilings.

B. Related Sections include, but are not limited to, the following:

1. Section 05 50 00 “Metal Fabrications” for slotted channel support framing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

C. Samples for Initial Selection: For units with factory-applied finishes.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Cell Grids: Set of full-size module Samples of each type, finish, and color.
2. Beam Grids: Set of 12-inch-long Samples of each type, finish, and color; a 12-inch-long spliced section; and a 6-inch-long per leg corner section.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lighting fixtures.
2. Air outlets and inlets.
3. Speakers.
4. Sprinklers.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Suspended Decorative Grids: Quantity of each suspended decorative grid component, exposed molding, and trim equal to 2 percent of quantity installed.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver suspended decorative grid components to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they are protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Handle suspended decorative grids and accessories to avoid damaging units and finishes.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.2 SUSPENDED DECORATIVE GRIDS, GENERAL

A. Sheet Metal: Selected for surface flatness, smoothness, and freedom from surface blemishes where exposed to view in finished unit. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, variations in flatness exceeding those permitted by referenced standards for stretcher-leveled metal sheet, stains, discolorations, or other imperfections.

B. Grid Fabrication: Components are formed from metal indicated. Manufacturer's standard units of size, shape, and profile indicated; finished to comply with requirements indicated. Provide cells factory assembled into modular panel.

C. Cover Profiles and Trim: Provide manufacturer's standard cover profiles and trim for exposed members, and as indicated or required, for edges of grids, at changes in ceiling height, and for other conditions, of same metal and finish as suspended decorative grids.

D. Metal Suspension-System Standard: Provide ceiling manufacturer's standard metal suspension systems of types and finishes indicated that comply with applicable ASTM C635/C635M requirements. Provide systems complete with runners or beams, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, web covers, load-resisting struts,

fixture filler pans, clips and adapters, and other suspension components required to support ceiling units and other ceiling-supported construction.

E. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at 3 times hanger design load indicated in ASTM C635/C635M, Table 1, Direct Hung, is less than yield stress of wire, but provide not less than 0.135-inch- diameter wire.

F. Supports for wire hangers: Slotted Channel Support framing with rust protected with rust-inhibitive paint.

G. Exposed Metal Edge Moldings, Covers, Trim, and Fixture Filler Panels: Provide exposed members as indicated or required to conceal edges of and penetrations through ceiling, to conceal edges of beams, to cover runner webs, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching suspended decorative grids unless otherwise indicated.

2.3 ALUMINUM OPEN CELL UNITS FOR SUSPENDED DECORATIVE GRIDS (MC-1)

A. Subject to compliance with the requirements provide METALWORKS Open Cell Grid, Square Lay-in metal ceiling system as manufactured by Armstrong World Industries or a comparable open cell metal ceiling system by one of the following:

1. Certainteed, a Saint-Gobain company; Open Cell Ceiling System
2. Hunter Douglas; Luxalon Open Cell Ceiling System.

B. Aluminum Sheet: Roll-formed aluminum sheet, complying with ASTM B209; alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

1. Sheet Metal Thickness: Not less than 0.020 inch.

C. Beam Grid Module: 24 inches square.

D. Cell Panel Module: 24 inches nominal square.

E. Cell Module: 6 inches square.

F. Cell Profile, Width by Height: 3/8 by either 1-1/2 or 2 inches.

G. Finish: Custom RAL color as selected by Architect from one of 180 RAL indexed colors

2.4 GRID SUSPENSION SYSTEM GRID UNITS FOR SUSPENDED DECORATIVE GRIDS

A. Subject to compliance with the requirements provide Suprafine 9/16” square edge ceiling system as manufactured by Armstrong World Industries or a comparable open cell metal ceiling grid suspension system by one of the following:

1. Certainteed
2. Hunter Douglas

B. Provide manufacture’s perimeter Edge System at all ceiling perimeters

C. Finish: Same finish and custom RAL color to match aluminum open cell lay-in units

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each installation area and establish layout of suspended decorative grids to balance border widths at opposite edges of each space. Comply with layout shown on reflected ceiling plans.

B. Center grid within room; provide equal dimensions of open cells at perimeters each way.

3.3 INSTALLATION

A. Install suspended decorative grids to comply with ASTM C636/C636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within plenum that are not part of supporting structure or of grid suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for structure to which hangers are attached and for hanger type involved.
5. Do not attach hangers to steel deck tabs.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of three tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with expansion anchors.

D. Install edge moldings and trim of type indicated at perimeter of each suspended decorative grid and where necessary to conceal edges of grids.

1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, level with ceiling system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspended decorative grids in coordination with suspension system and exposed moldings and trim. Comply with installation tolerances according to CISCA's "Metal Ceilings Technical Guidelines."

1. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated.
2. Fit adjoining units to form flush, tight joints.
3. Where grid edges are visible, install cover profiles unless other trim is indicated.

3.4 CLEANING

A. Clean exposed surfaces of suspended decorative grids, including trim and edge moldings, after removing strippable, temporary protective covering if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, cleaning, and touchup of minor finish damage. Remove and replace grid components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and deformed grids.

END OF SECTION 09 54 36

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Resilient base.
2. Metal Transition Strips

B. Related Sections:

1. Division 09 Section "Resilient Tile Flooring" for resilient floor tile.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70^{O} F or more than 95^{O} F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.

3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55^{O} F or more than 90^{O} F temperature.

C. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Resilient Base: Furnish not less than 48 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed. Provide in sealed boxes with label affixed indicating Product Name, Color, and Type.

2. Resilient Molding Accessories: Furnish not less than 5% of each type, color, pattern, and size of resilient molding product installed. Provide in sealed boxes with label affixed indicating Product Name, Color, and Type.

PART 2 - PRODUCTS

2.1 RESILIENT BASE (RB-1,RB-2)

A. Resilient Base:

1. Manufacturer/Product: Subject to compliance with requirements, provide Resilient Base as manufactured by Burke or a comparable product manufactured by one of the following:
   a. Johnsonite
   b. Roppe Corporation USA

B. Resilient Base Standard: ASTM F 1861.

1. Material Requirement: Type TS (rubber, vulcanized thermoset).
2. Manufacturing Method: Group I (solid, homogeneous).
3. Style: Straight (toeless).

C. Minimum Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed.

G. Inside Corners: Job formed.

H. Finish: As selected by Architect from manufacturer's full range.

I. Colors and Patterns:

1. RB-1:
   a. Burke:”198 “Deep Space”
   b. Johnsonite: - VL4 Cool Metal CG”
   c. Roppe: #123 “Charcoal”

2. RB-2:

2.2 METALTRANSISTION STRIPS

A. VCT-LVT to Concrete Slab Metal Transition Strips (T3):

1. Subject to compliance with requirements, provide products by one of the following:
   a. Schluter: VINPRO- U; 3mm
   b. Tarkett Commercial: Slim-Line; SLTC 69 J .080 Contour Edge (1/8”)
   c. Genotek: VCT Edge 1/8”
   d. Or an approved equal

2. Description: Metal Reducer strip for transitioning vinyl composite or luxury vinyl tile to concrete floor
   a. Material: Aluminum
   b. Profile and Dimensions: 1/8” high with contoured/sloped transition slope to near 0”.
   c. Finish: Satin Aluminum/Matte Silver/ Brushed Chrome to be selected by Architect.
   d. Install per manufacturer’s instructions

3. Install per manufacturer’s instructions.

B. Carpet to Concrete Slab Metal Transition Strips (T1):

1. Subject to compliance with requirements, provide products by one of the following:
   a. Schluter: VINPRO- U; Height to be sized to correctly capture carpet edge
   b. Tarkett Commercial: Slim-Line; SLTC 69 J .080 Contour Edge (1/8”)
   c. Genotek: VCT Edge 1/8”
   d. Or an approved equal

2. Description: Metal Reducer strip for transitioning carpet to concrete
   a. Material: Aluminum
   b. Profile and Dimensions: 1/4” high with contoured/sloped transition slope to1/8”.
   c. Finish: Satin Aluminum/Matte Silver/ Brushed Chrome to be selected by Architect.

3. Install per manufacturer’s instructions.

C. Porcelain/Ceramic Tile to Concrete Metal Transition Strips (T2):

1. Subject to compliance with requirements, provide products by one of the following:
   a. Schluter
   b. Laticrete
   c. Genotek
   d. Or an approved equal

2. Description: Metal Reducer strip for transitioning carpet to concrete.
   a. Material: Aluminum

b. Profile and Dimensions: 3/8” high with contoured/sloped transition slope to near 0”.
c. Finish: Satin Aluminum/Matte Silver/ Brushed Chrome to be selected by Architect.

3. Install per manufacturer’s instructions

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Cove Base Adhesives: Not more than 50 g/L.
b. Rubber Floor Adhesives: Not more than 60 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products until Substantial Completion.

END OF SECTION 09 65 13

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SECTION 09 65 19.13 - LUXURY VINYL TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Commercial Solid (Luxury) vinyl floor tile flooring.

B. Related Sections include the following:

1. Division 09 Section "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.
2. Division 03 Section "Hydraulic Cement Underlayment" for trowelable leveling material.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Submittals: Provide the following:

1. Low Emitting Materials: USGBC low-emitting materials calculation and provide product data (MSDS, third party certifications, testing reports) for the following:
   a. Adhesives and sealants applied onsite indicating VOC content of each product used.

C. Shop Drawings: For each type of resilient floor tile.

1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

D. Samples: Full-size units of each color, texture, and pattern of floor tile required.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following periods:
1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

1.10 WARRANTY

A. Provide manufacturer's 15 year Commercial Warranty:

1. Manufacturing Defects – The Company warrants that the resilient product will be free from manufacturing defects during the period of this warranty. Manufacturing defects include delamination, core voids, thickness variation, and dimensional stability defects. Dimensional stability related defects are defined as dimensional changes in the width and/or length of the product greater than the tolerances as defined in ASTM F2199. Thickness variation is defined as thickness exceeding the thickness tolerance as defined in ASTM F386.

B. Wear – The Company warrants, during the period of the warranty, wear due to normal foot traffic will not wear through to the pattern layer of the product

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 SOLID (LUXURY) VINYL FLOOR TILE (LVT-1)

A. Basis of Design: Subject to compliance with the requirements, provide Look Both Way Collection; Style Walk the Aisle; Color #A01304 “Carbon” Commercial Solid (Luxury) Vinyl Floor Tile with acoustic backing as manufactured by Interface or a comparable product by one of the following:

1. Shaw Contract; Amalgam #4113V “ Onyx
2. TBD

B. Class: Class lll, Type B

C. Overall Thickness: 4.5 mm
1. Wear layer .Thickness: 22 mil

D. Size: 50 cm x 50 cm

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation:

1. Provide for the installation of 1/4” thick trowelable underlayment leveling at 50% of total Luxury Vinyl Tile area.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by luxury vinyl tile manufacturer.
2. Subfloor finishes comply with requirements specified in Division 03 Section "Cast-in-Place Concrete" for slabs receiving luxury vinyl tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SLAB MOISTURE AND pH TESTING

A. Provide the following slab moisture and pH testing in each area scheduled to receive Tile Carpeting. Provide Written Testing Reports.

1. ASTM F-1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride is used to determine the moisture vapor emission rate (MVER) of the concrete
2. ASTMF-2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes is used to determine the percentage of relative humidity of the concrete at 40% of the depth of the concrete slab.
3. ASTM F-710-05 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring is used to determine the surface pH of the concrete.

3.3 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Do not install floor tiles until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

C. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile

3.4 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis Insert requirements.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain running in one direction.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

E. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply three coat(s).

E. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

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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 modular, carpet tile.

B. Related Sections include the following:

1. Division 09 Section "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.
2. Division 03 Section "Hydraulic Cement Underlayment" for trowelable leveling material.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate.

B. Shop Drawings: Show the following:
1. Carpet tile type, color, and dye lot.
2. Type of installation.
3. Pattern of installation.
4. Pattern type, location, and direction.
5. Type, color, and location of edge, transition, and other accessory strips.
6. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- (300-mm-) long Samples.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

E. Qualification Data: For Installer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.

G. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

H. Warranty: Special warranty specified in this Section.

I. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

J. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104, Section 5, "Storage and Handling."

1.5 PROJECT CONDITIONS

A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."

B. Environmental Limitations: Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

1.6 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, dimensional stability, excess static discharge, and delamination.
3. Warranty Period: 10 years from date of Substantial Completion.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units (from same production run as installed materials) equal to 5 percent of amount installed for each type indicated, but not less than 15 sq. yd.

PART 2 - PRODUCTS

2.1 MODULAR CARPET TILE

A. Carpet Tile (CPT-1): Subject to compliance with the requirements provide Relaxing Floor Collection, chilD-GT424 series, Color: Harmony #961 as manufactured by Mohawk Group or a comparable product in color, pattern, and materials by one of the following manufacturers:

1. J+J Flooring; Adapt Series/Collection; Color: Carbon Path # 3274
2. Interface; Common Theme Collection; CT112 Series; Color: Onyx # 104353

B. Material Description:

1. Construction: Textured Patterned Multi-colored loop
2. Tufted Pile Weight: 23 oz/sq yd min.
3. Gauge:1/12
4. Stitches per Inch: 28.5
5. Total Thickness: 0.262 in
6. Pile Thickness: 0.097 inch
7. Density Factor: 9,300 oz/y^3
8. Fiber System: Nylon
9. Dye Method: 100% Solution Dyed
10. Primary Tufting Substrate: Synthetic Non-Woven
11. Modular Size: 12 inch by 36 inch
12. Secondary Backing: Polypropylene
13. Applied Soil-Resistance Treatment: Yes
14. Performance Characteristics: As follows:
    a. Class 1 Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm
    b. Electrostatic Propensity: Less than 1.1 kV per AATCC 134.
    c. Flammability: Passes Methenamine Pill Test (CPSC-FF1-70)
15. Adhesive Methods:
    a. Manufacturer’s standard non-reactive full spread pressure sensitive adhesive allowing for multiple lifts/ replacements.
16. Installation: Ashlar

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

1. For Carpet Tile Types CPT-1: Provide for the installation of 1/4” thick trowelable underlayment leveling at 50% of total carpet tile area.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

1. VOC Limits: Provide adhesives with VOC content not more than 1 g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
2. Subfloor finishes comply with requirements specified in Division 03 Section "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SLAB MOISTURE AND pH TESTING

A. Provide the following slab moisture and pH testing in each area scheduled to receive Tile Carpeting. Provide Written Testing Reports.

1. ASTM F-1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride is used to determine the moisture vapor emission rate (MVER) of the concrete
2. ASTM F-2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes is used to determine the percentage of relative humidity of the concrete at 40% of the depth of the concrete slab.
3. ASTM F-710-05 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring is used to determine the surface pH of the concrete.

3.3 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.4 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Install Vapor Resistant Underlayment per manufacturer's written instructions. Underlayment shall be installed in the entire area of each room where Tile Carpeting is scheduled and in accordance to Allowances.

C. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

D. Maintain dye lot integrity. Do not mix dye lots in same area.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.5 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protection of Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

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. Provide labor, materials, and equipment necessary for complete painting and finishing work as detailed on the Drawings and as specified herein, of surfaces as scheduled throughout the building.

B. The type of material to be used and the number of coats to be applied are listed in the "Exterior and Interior Painting Schedule" in Part 3 of this Section of these Specifications. Refer to the Drawings and Finish Plans for additional information.

C. The term "paint" as used herein, includes enamels, paints, sealers, stains, fillers, emulsions, and other coatings, whether used as prime, intermediate, or finish coats.

D. The Architect shall not be limited in the number of colors selected for single space or for the complete Project.

E. The intent is to provide a completely finished building, interior and exterior, whether or not specifically indicated. Some items may not be specifically indicated to be painted on the Drawings, the schedules, or herein, however, all items shall be finished and/or painted as directed by the Architect, whether or not specifically scheduled or indicated as such.

1.3 SUBMITTALS

A. Materials List: Prior to the start of Work and before paint materials are delivered to the job site, submit to the Architect a complete list of materials proposed and equivalent to specified painting schedule, to be provided under this portion of the Work.

1. This shall in no way be construed as permitting substitution of materials for those specified or approved for this Work by the Architect.

B. Provide the following:

1. Low Emitting Materials: USGBC low-emitting materials calculation and provide product data (MSDS, third party certifications, testing reports) for the following:
   a. Adhesives and sealants applied onsite indicating VOC content of each product used.
   b. Paints and coatings applied onsite indicating VOC content of each product used.

C. Color Chip Catalog: Paint manufacturer shall provide Architect with a complete current color chip catalog from which he may select colors. Manufacturers may fulfill this requirement by updating catalog that Architect may presently have in his possession.

D. Submit two samples 9 x 9 inch in size illustrating selected colors and textures for each color selected.

E. Stain Samples: Submit sample of specified wood species with selected stain applied to specified wood types to Architect for approval. Resubmit additional samples as necessary to obtain color desired by Architect.

F. Manufacturer's Recommendations: In each case where material proposed is not the material specified or specifically described as an acceptable manufacturer in this Section of these Specifications, submit for the Architect's review the current recommended method of application published by the manufacturer of the proposed material.

1.4 QUALITY ASSURANCE

A. Qualifications of Painters: Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces; in the acceptance or rejection of installed painting, no allowance will be made for lack of skill on the part of painters.

B. Codes and Standards: In addition to complying with pertinent codes and regulations, comply with "Standard (Type 1)" as defined by the Painting and Decorating Contractors of America in their "Modern Guide to Paint Specifications," current edition.

C. Field Samples:

1. Provide a complete room field sample illustrating coating color, texture, and finish.
2. Provide exterior field sample at an outside corner condition with finish extending minimum 10 feet both directions and selected height.
3. Locate where directed by Architect and Owner.
4. Accepted sample may remain as part of the work.

D. Environmental Requirements:

1. All Interior Paints and Coatings shall meet the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for architectural Coatings, or the South Coast Air Quality Management District Rule 113, effective June 3, 2011.

a.	Non-flat	150 g/l
b.	Flat	50 g/l
c.	Anti-corrosive/anti-rust	205g/l

2. Paints shall be manufactured without the use of any formaldehyde precursors.
3. Do not apply materials when the surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer
4. Do not apply exterior coating during rain, snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer

1.5 **PRODUCT HANDLING**

A. Delivery: Deliver paint materials to the job site in their original unopened containers with labels intact and legible at time of use.

B. Protection

1. Store only the approved materials at the job site and store only in a suitable and designated area restricted to the storage of paint materials and related equipment.
2. Use means necessary to ensure the safe storage and use of paint materials and the prompt and safe disposal of waste.
3. Use means necessary to protect paint materials before, during, and after application and to protect the installed work and materials of other trades.

1.6 **EXTRA STOCK**

A. Upon completion of this portion of the Work, deliver to the Owner an extra stock of paint consisting of five (5) gallons of each color used in each coating material used, with such extra stock tightly sealed in clearly labeled containers.

PART 2 - PRODUCTS

2.1 PAINTING MATERIALS MANUFACTURER

A. Painting materials shall be the products of the following manufacturers, specified as the type, function, and quality of products to be provided. Paint materials and specification numbers listed herein, unless otherwise designated, are the products of Sherwin-Williams.

B. Products of the following manufacturers are acceptable as equal to Sherwin-Williams Co. providing their products equal or exceed the quality specified, and the material types and composition are the same.

1. PPG Industries, Pittsburgh, Pennsylvania
2. Benjamin Moore & Company, Montvale, New Jersey.
3. Or an Approved Equal.

2.2 **COMPATIBILITY**

A. Paint materials selected for coating systems for each type of surface shall be the product of a single manufacturer.

B. Paint materials and equipment shall be compatible in use; finish coats shall be compatible with prime coats; prime coats shall be compatible with the surface to be coated; tools and equipment shall be compatible with the coating to be applied.

C. Thinners, when used, shall be only those thinners recommended for that purpose by the manufacturer of the material to be thinned.

2.3 ACCEPTANCE OF SPECIFICATIONS

A. By submitting a proposal, the Contractor has reviewed the bidding documents with the painting subcontractor and accepts the Specifications as sufficient to produce approved painting results. If the painting subcontractor contends that the materials or number of coats specified will not produce satisfactory results, notify Architect through the Contractor 10 days prior to receipt of bids for proper action.

2.4 MATERIALS

A. Coatings: Ready mixed, except field catalyzed coatings. Prepare pigments:

1. To a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.
2. For good flow and brushing properties.
3. Capable of drying or curing free of streaks or sags.

B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified; commercial quality.

C. All paint systems shall be scrubbable.

PART 3 - EXECUTION

3.1 INSPECTION

A. Applicator must examine areas and conditions under which painting work is to be applied and notify the Architect in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator.

B. Starting of painting work will be constructed as Applicator's acceptance of surfaces and conditions within any particular area.

C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint surface.

D. Test shop applied primers for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the maximums as recommended, for the types of coatings to be used, by the manufacturer.

3.2 SURFACE PREPARATION

A. General

1. Perform preparation and cleaning procedures in accordance with paint

manufacturer's instructions, and as herein specified, for each particular substrate condition.

2. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish painted or provide surface applied protection prior to surface preparation and painting operations; remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.
3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminates from cleaning process will not fall onto wet, newly painted surfaces.

B. Cementitious Materials

1. Prepare cementitious surfaces of concrete, concrete block, and cement plaster to be painted by removing efflorescence, chalk, dirt, grease, oils, and by roughening as required to remove glaze.
2. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
3. Clean concrete floor surfaces scheduled to be painted with a commercial solution of muriatic acid or other etching cleaner. Flush floor with clean water to neutralize acid and allow to dry before painting.

C. Ferrous Metals

1. Clean ferrous surfaces, which are not galvanized or shop coated, of oil, grease, dirt, loose mill scale, and other foreign substances by solvent or mechanical cleaning.
2. Touch-up shop applied prime coats wherever damaged or bare, where required by other Sections or these Specifications. Clean and touch-up with same type shop primer.

D. Galvanized Surfaces: Clean free of oil and surface contaminates with nonpetroleum based solvent.

E. Gypsum Board Surfaces: Fill minor defects with filler compound and spot prime defects after repair.

3.3 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's direction.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.4 APPLICATION

A. General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint, until paint film is of uniform finish, color, and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only before final installation of equipment.
3. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.
4. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
5. Finish exterior doors on tops, bottoms, and side edges same as exterior faces unless otherwise indicated.
6. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat material to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
2. Slightly vary the color of succeeding coats.

C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate and as specified herein, to establish a total dry film thickness as indicated or, if not indicated, as recommended by the coating manufacturer.

D. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed to view in interior occupied spaces and exterior walls. Mechanical rooms and electrical rooms are not considered occupied spaces unless specifically noted as such.

E. Prime Coats: Apply prime coat of material that is required to be painted or finished and that has not been prime coated by others.

1. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn through or other defects due to insufficient sealing.
2. Coordinate manufacturer’s prime coats with finish coats as specified herein. If compatibility is not ascertained during the bidding period, and verification submitted with the shop drawings, then prime coat paint system as specified herein shall be applied to the item prior to finish painting as specified herein.

F. Pigmented (Opaque), Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps,

brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

G. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

3.5 CLEAN-UP AND PROTECTION

A. Clean-Up: During progress of Work remove from site discarded paint materials, rubbish, cans, and rags at end of each work day.

B. Upon completion of painting work clean window glass and other paint- spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

C. Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct damage by cleaning, repairing or replacing and repainting, as acceptable to Architect.

D. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

E. At the completion of Work of other trades, touch-up and restore damaged or defaced painted surfaces.

3.6 PAINT TYPES AND NUMBER OF COATS

A. The following painting schedules are intended to identify the type of finishes which are required for the various surfaces, and to identify the surfaces to which each finish is to be applied. Refer to Finish Schedule.

B. To define requirements for quality, function, size, gages, textures, and color, the following list of materials designates the manufacturer's brand, types, and number of coats required; and other requirements that are to be furnished to conform to the requirements of this Project.

C. Where specific finishes are called for on the Drawings and in the Finish Schedule by code designation, it shall specifically refer to the following identified types of coatings.

D. The primer indicated under Material Identification is intended for the particular substrate surface specified. Where the same numbered finish is scheduled, but for another substrate, provide the proper primer compatible with substrate and the finish.

E. Where the substrate has a compatible and satisfactory prime coat already on it, the prime coat specified for the numbered finish may be omitted. Test prime coat for compatibility before applying additional coats.

3.7 EXTERIOR PAINTING SCHEDULE

A. Provide the following exterior paint systems based on Sherwin-Williams products for substrates indicated. Other acceptable manufacturers having comparable interior paint

systems are Benjamin-Moore and PPG Industries.

B. Ferrous Metal Surfaces: Provide the following finish system over miscellaneous steel, etc. where scheduled, noted to be painted, or exposed to view surfaces:

1. Epoxy, Semi-Gloss Finish (PES-1):

a. Primer: Metal primer.

1) Basis of Design: Sherwin-Williams' "Pro-Cryl Universal Primer""

b. First and Second Coat: Semi-Gloss, pre-catalyzed, water-based epoxy applied at spreading rate recommended by the manufacturer.

1) Basis of Design: Sherwin-Williams' "Pro-Industrial Precatalyzed Epoxy"; K46-150 Series.

C. Ferrous Metal Surfaces: Provide the following finish system over exterior hollow metal doors, frames, pipe railings miscellaneous steel, etc. and/or where scheduled, noted to be painted, or exposed to view surfaces:

1. Acrylic Finish, Semi-Gloss:

a. Primer: Metal primer:
1) Sherwin-Williams' "Pro-Cryl Universal Primer""

b. First and Second Coat: Acrylic, water-based applied at spreading rate recommended by the manufacturer:
1) Sherwin-Williams' "Pro-Industrial Acrylic"; B66 Series.

c. Color as scheduled on the drawings.

3.8 INTERIOR PAINTING SCHEDULE

A. Provide the following interior paint systems based on Sherwin-Williams products for substrates indicated. Other acceptable manufacturers having comparable interior paint systems are Benjamin Moore and PPG.

B. Gypsum Board: Provide the following finish systems over interior gypsum board wall surfaces where indicated:

1. Interior Vinyl Acrylic, Eg-Shel Finish (PLE-1, PLE-2, PLE-3)

a. Primer: Vinyl Acrylic, interior primer

1) Sherwin-Williams: "Promar 200 Zero VOC Interior Latex Primer"

b. First and Second Coats: Interior Vinyl Acrylic:

1) Sherwin-Williams:"ProMar 200 Zero VOC Interior Latex Eg-Shel"; B30-2600 series.

c. Colors as scheduled on the drawings.

C Gypsum Board: Provide the following finish systems over interior gypsum board ceiling, soffit, and accent color surfaces:

1. Interior Vinyl Acrylic, Flat Finish (PLF-1, PLF-2)

a. Primer: Vinyl Acrylic, interior primer
1) Sherwin-Williams: “Promar 200 Zero VOC Interior Latex Primer”

b. First and Second Coats: Interior Vinyl Acrylic:
1) Sherwin-Williams’ ”ProMar 200 Zero VOC Interior Latex Flat”; B30-2600 series.

c. Colors as scheduled on the drawings.

D. Gypsum Board: Provide the following finish systems over interior gypsum board wall surfaces where indicated:

1. Water-based , Semi-Gloss Finish (PES-1, PES-2):

a. Primer:
1) Sherwin-Williams’ “Pro-Cryl Universal Primer””

b. First and Second Coat: Semi-Gloss, pre-catalyzed, water-based epoxy applied at spreading rate recommended by the manufacturer.
1) Sherwin-Williams’ “Pro-Industrial Precatalyzed Epoxy”; K46-150 Series.

E. Ferrous Metal Surfaces: Hollow metal doors, frames, miscellaneous steel, etc. and/or where scheduled, noted to be painted, or exposed to view surfaces: Provide the following finish systems over interior ferrous metal:

1. Acrylic Finish, Semi-Gloss (PAS-1, PAS-2):

a. Primer: Metal primer:
1) Sherwin-Williams’ “Pro-Cryl Universal Primer””

c. First and Second Coat: Acrylic, water-based applied at spreading rate recommended by the manufacturer:
2) Sherwin-Williams’ “Pro-Industrial Acrylic”; B66 Series.

d. Color as scheduled on the drawings.

F. Concrete Floors: Provide the following finish where indicated on the Finish Schedule to receive Sealed Concrete:

1. Concrete Sealer (SC-1)

a. Two Coats: Water-based floor concrete sealer.
b. Provide “H&C Clarishield Wet-Look Concreter Sealer” as manufactured by H&C products or a comparable product by one of the following:
1) Direct Colors: AcquaSeal Water based, high gloss acrylic concrete sealer
2) Seal-Krete: Wet Look Concrete Sealer.

c. Slip Resistance Additive: Provide manufacturer's recommended additive for slip resistance in first coat.

G. Waterborne Acrylic Dryfall; Eg-shel (PES-1):

1. Overhead Exposed to View Ferrous Metal/ Non-Ferrous Metal Surfaces: Purlins, Underside of Roof Panels, Un-insulated Ductwork, Conduits, Un-jacketed piping. etc:

a. Prime Coat for steel and rusted galvanized metals:
   1) One (1) coat of Sherwin-Williams Pro Industrial WB Pro-cryl Primer or DTM Acrylic Primer.
b. For un-rusted, galvanized steel; primer is not required.
c. First and Second Coat:
   1) SW Waterborne Acrylic Dryfall, Eg-Shel.

END OF SECTION 09 91 00

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. Procedures for compliance with certain sustainability requirements for the Project to obtain LEED v4 Certification apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Phenolic-core toilet compartments configured as toilet enclosures and urinal screens.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For toilet compartments.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of reinforcements for compartment-mounted grab bars.
4. Show locations of centerlines of toilet fixtures.

C. Samples for Initial Selection: For each type of unit indicated. Include Samples of hardware and accessories involving material and color selection.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for units, prepared on 6-inch- (152-mm-) square Samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

E. Product Certificates: For each type of toilet compartment, from manufacturer.

F. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Comply with requirements in GSA's CID-A-A-60003, "Partitions, Toilets, Complete."

B. Fire Resistance: Class A; Class I Material
1. Flame Spread Index (ASTM E 84): 15-25 for panels, stiles and doors.
2. Smoke Developed Index (ASTM E 84): 25 - 105 for panels, 20-90 for stiles.

C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC A117.1 for toilet compartments designated as accessible.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M).

B. Brass Castings: ASTM B 584.

C. Brass Extrusions: ASTM B 455.

D. Steel Sheet: Commercial steel sheet for exposed applications; mill phosphatized and selected for smoothness.

1. Electrolytically Zinc Coated: ASTM A 879/A 879M, 01Z (03G).

E. Stainless-Steel Castings: ASTM A 743/A 743M.

2.2 COMPACT LAMINATE (SOLID PHENOLIC) TOILET PARTITIONS

A. Subject to compliance with the requirements, provide “Duraline” Gap Free Doors and Stiles Series, 1180CGL as manufactured by Bobrick or a comparable product by one of the following manufacturers

1. Bradley Corporation “Mills Privacy” Series

2. ASI: Ultimate Privacy Series

B. Design Type:

1. Maximum Height
   a. Door/Panel Height: 71-3/4 inches
   b. Floor Clearance: 4-1/2 inches

C. Privacy Style Partitions: No sightlines with gap-free interlocking doors and stiles routed 0.300 inches (7.6 mm) from the edge to allow 0.175 inch (4.4 mm) overlap to prevent line-of-sight into the toilet compartment

D. Mounting Configuration:

1. Floor-mounted, overhead-braced with anodized aluminum headrails, 0.065 inch (1.65 mm) thick with anti-grip profile.

a. Stile Maximum Height: 83 inches

2.3 COMPACT LAMINATE (SOLID PHENOLIC) URINAL SCREENS

A. Subject to compliance with the requirements, provide “Duraline” Urinal Screens as manufactured by Bobrick or a comparable product by one of the following manufacturers

1. Bradley Corporation
2. ASI

B. Mounting Configuration

1. Wall-hung
   a. Screen Height: 48 inches with 12 inches floor clearance

2.4 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Material: Stainless steel.
2. Hinges: Manufacturer's standard paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees.
3. Latch and Keeper: Manufacturer's standard recessed latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.5 FINISHES

A. Face finishes of partitions and urinal screens shall be selected by Architect from manufacturer’s premium colors offerings

2.6 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Door Size and Swings: Unless otherwise indicated, provide 24-inch wide, in-swinging doors for standard toilet compartments and 36-inch wide, out-swinging doors with a minimum 32-inch-wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch.
b. Panels and Walls: 1 inch.

2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.

a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 13

SECTION 10 26 00 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Corner guards.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Corner Guards: 12 inches long.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of corner guard

B. Material Certificates: For each type of exposed plastic material.

C. Sample Warranty: For special warranty.

1.5 PROJECT COORDINATION

A. Conduct pre-installation meeting with Contractor, Architect, Owner and other wall and base finish trade contractors to discuss corner guard installation requirements and sequence of installation of other wall and base finishes.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Corner Guards: Full-size covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two, full height long units.
2. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

a. Store corner and end cap guard covers in accordance to manufacturer's recommendations

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain corner and end wall guard products of each type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.

2. Smoke-Developed Index: 450 or less.

2.3 CORNER GUARDS (CG-1, CG-2)

A. Surface-Mounted, Snap-on Opaque Corner Guards (CG-1, CG-2): Fabricated as two piece from Polyethylene Terephthalate Glycol (TEPG); with formed edges; fabricated with 90 degree turn to match wall condition.
   1. CG-1 indicates one unit
   2. CG-2 indicates two units at an end wall termination condition.

B. Subject to compliance with the requirements provide, Acrovyn Model 4000- SSM-20AN Series Snap-on corner guards as manufactured by Construction Specialties (CS) or a comparable product by one of the following manufacturers:

   1. Inpro: 160 High Impact Corner Guard
   2. Koroseal Korogard G100 series.
   3. Wing Size: Actual 2 inches by 2 inches.
   4. Bullnose: No
   5. Eased Corner Edge: 1/4 inch radius
   6. One Piece Length: 4 feet
   7. End caps T&B
   8. Mounting: 6063-T6 Alloy nom 0.062 " thick Extruded Aluminum Retainer
   9. Color and Texture:
      a. (1) Color to be selected from manufacturers standard solid color offering of a minimum of 52 colors
      b. Texture: Light sand

2.4 MATERIALS

A. Fasteners: All fasteners to be non-corrosive and compatible with aluminum retainers. All fasteners to be supplied by the manufacturer. recommended by protection product manufacturer.

2.5 FABRICATION

A. Fabricate wall protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

2.6 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine walls to which wall will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment.

1. For wall protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall and door protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

C. Temperature of all wall protection materials must be kept between 65 degrees F and 75 degrees F at least 24 hours prior to installation.

3.3 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
1. Corner Guards shall be installed to a height matching the top of hollow metal door frames (typically 7’ – 2” from finish floor) and shall be in one piece; no seaming is allowed.

B. Corner guards mount as follows:
1. At walls with wood base; mount on top of wood base unless noted otherwise in the drawings.
2. At walls with resilient base; mount on top of resilient base unless noted otherwise in the drawings.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 26 00

SECTION 10 28 00 – TOILET, BATH AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Custodial accessories.
3. Underlavatory guards.

B. Related Sections:

1. Division 06 Section "Rough Carpentry" for concealed wood blocking to support fixtures.
2. Division 08 Section "Mirrors" for frameless mirrors.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

1.6 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.

B. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

C. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

D. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Basis-of-Design Products: Subject to compliance with requirements, provide products by Bobrick Washroom Equipment or a comparable product by one of the following:

1. American Specialties, Inc.
2. Bradley Corporation.
3. Or an Approved Equal.

B. Framed Mirror Unit (TA-1A):

1. Basis-of-Design Product: Bobrick; Model # B-2908.
2. Frame: Stainless-steel angle, 0.05 inch thick.
    a. Corners: Welded and ground smooth.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
    a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
4. Size: 36 inches high x 24 inches wide.

C. Wall Mounted liquid-Soap Dispenser (TA-2)

1. Basis-of-Design Product: Bobrick; Model # B4112 (For use with non-antibacterial soap)
2. Mounting: Surface mounted.
3. Door or Cover: Locking top cover.
4. Capacity: 40 fl oz.
5. Soap Refill indicator
6. Material and Finish: Type 18-8 304 20ga. Stainless steel, No. 4 finish (satin).

D. Sanitary-Napkin Disposal Unit (TA-3)

1. Basis-of-Design Product: Bobrick; Model # B254.
2. Mounting: Surface mounted.
3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
4. Receptacle: Removable, 1.2 gallon leak-proof plastic.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

E. Toilet Tissue (Twin Jumbo Roll) Dispenser (TA-5):

1. Basis-of-Design Product: Bobrick; Model # B2892
2. Mounting: Surface mounted (under grab bar)
3. Door: Hinged, swing down, locking door with viewing slots to indicate roll supply.
4. Material and Finish: Cabinet and Door with 18-8 Type 304 Stainless steel, No. 4 finish (satin).
5. Dispensing Mechanism: High-Impact ABS with sliding access panel to expose one roll at a time.
6. Toilet Tissue Type requirements: Maximum 10” diameter rolls with maximum 3“diameter core (can be field converted to accommodate rolls with a 2.25” core).

F. 18” Long Grab Bar: (TA-6):

1. Basis-of-Design Product: Bobrick; Model # 6806.99 x 18.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.

    a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: Straight; 18 inches

G. 36” Long Grab Bar: (TA-7):

1. Basis-of-Design Product: Bobrick; Model # 6806.99 x 36.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.

    a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: Straight; 36 inches.

H. 42 “ Long Grab Bar (TA-8):

1. Basis-of-Design Product: Bobrick; Model # 6806.99 x 42.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.

    a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: Straight; 42 inches.

I. Combination Towel (Folded) Dispenser/Waste Receptacle (TA-11):

1. Basis-of-Design Product: Bobrick Classic Series; Model # 3944.
2. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
3. Mounting: Recessed with projecting receptacle.

    a. Designed for nominal 4-inchwall depth.
    b. Semi-recessed (2”) with manufacturer’s trim skirt.

4. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold paper towels.
5. Minimum Waste-Receptacle Capacity: 12 gal.
6. Material and Finish: Stainless steel, No. 4 finish (satin).
7. Liner: Reusable, vinyl waste-receptacle liner.
8. Lockset: Tumbler type for towel-dispenser compartment and waste receptacle.
9. Adaptable to receive a future Manufacturer’s battery operated automatic paper towel roll dispenser module (NIC).

2.3 CUSTODIAL ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide products by Bobrick Washroom Equipment or a comparable product by one of the following:

1. American Specialties, Inc.
2. Bradley Corporation.

B. Mop and Broom Holder (TA-21):
1. Basis-of-Design Product: Bobrick B-239 x 36.

C. Description: Unit with shelf, hooks and holders.
1. Length: 36 inches.
2. Hooks: Four.
3. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
4. Material and Finish: Stainless steel, No. 4 finish (satin).

    a. Shelf: Not less than nominal 0.05-inch thick stainless steel.

2.4 UNDERLAVATORY GUARDS

A. Under lavatory Guard (CFCI):
1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.

2. Material and Finish: Antimicrobial, molded plastic, white.
3. Locations: Provide at all Toilet Room Lavatories.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 00

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SECTION 12 36 61.19 - QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Quartz agglomerate countertops.
2. Quartz agglomerate backsplashes

B. Related Requirements:

1. Section 06 40 23 “Interior Architectural Woodwork” for counter substrates.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

D. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For quartz agglomerate countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.8 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

1.9 WARRANTY

A. Provide manufacturer’s lifetime warranty for material defects.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.

1. Products:

a. Quartz Agglomerate (QZ-1): Subject to meeting the requirements, provide Dove Grey Leathered quartz agglomerate as manufactured by Corian or a comparable product by one of the following:

1) Silestone -Camden 3 CM
2) Wilsonart -Q4042 Trail Ridge 3CM

B. Plywood Subtops: Exterior grade; 7-ply CAT PS1-09 Pine Sanded Plywood B/C.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium.

B. Configuration:

1. Front: Straight, with square eased edges and corners.
2. Backsplash: Straight, with square edges and corners.

C. Countertops: 3 cm thick, quartz agglomerate

D. Backsplashes: 3 cm- thick, quartz agglomerate.

E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

F. Joints: Fabricate countertops in sections for joining in field.

1. Minimize Joints as much as possible
2. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
3. Joint Type: Sealant filled, 1/16 inch in width.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by quartz agglomerate manufacturer.

1. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive quartz agglomerate countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

C. Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop,

form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

H. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants”.

END OF SECTION 12 36 61.19

SECTION 12 62 00.13 – UPHOLSTERED SEAT CUSHIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular Shaped, Fabric-Covered Upholstered Bench Seat and Bench Back Cushions.

B. Related Sections:

1. Section 01 21 00 “Allowances” for Lump Sum Allowance (LS-1) for fabric material to be selected by Owner for purchase by the Contractor.

2. Section 06 10 00 “Rough Carpentry” for fire-retardant-treated plywood backing panels for seating bench.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Fabric
2. Cushion Foam

B. Shop Drawings:

1. Plan and Section Details drawn at 1” – 1’-0” of Fabric-Covered, Upholstered Seat Cushion

C. Samples: As follows:

1. Fabric: Submit a minimum of five (5) 6” x 6” samples for verification selection

2. Cushion Foam: Submit a minimum of five (5) 6” x 6” x 4” deep samples.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.
1. Provide test reports from third party testing laboratories that indicate upholstery fabric and cushion foam meets or exceeds smoldering resistance as tested in accordance to California Technical Bulletin (TB) 117-2013.

1.4 ATTIC STOCK

A. Provide a minimum amount of 5 square yards of both fabric types FAB-1 and FAB-2 all from same production run of fabric for future seat covering replacement.

B. Provide a minimum amount of two additional (2) fully fabricated upholstered seat cushions with fabric from same run.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data for Fabric.

1.6 QUALITY ASSURANCE

A. Fabricator Installer Qualifications: Submit Fabricator /Installer qualifications indicating a minimum of three (3) years in the fabrication of commercial custom upholstered seat cushions.

PART 2 - PRODUCTS.

2.1 FABRIC-COVERED UPHOLSTERED BENCH SEAT CUSHIONS

A. Fabric (FAB-1): Fabric material to be purchased by Contractor under a lump sum allowance (LS-1).
   1. Fabric shall meet Smoldering Resistance: Meet or exceed smoldering resistance as tested in accordance to California Technical Bulletin (TB) 117-2013.

2.2 FABRIC-COVERED UPHOLSTERED BENCH BACK CUSHIONS

A. Fabric (FAB-2): Fabric material to be purchased by Contractor under a lump sum allowance (LS-1)
   1. Fabric shall meet Smoldering Resistance: Meet or exceed smoldering resistance as tested in accordance to California Technical Bulletin (TB) 117-2013.

2.3 CUSHION FOAM AND ACCESSORIES

A. Cushion Foam: Foam for Upholstered Cushion shall be 2.8 lb. density, high-resilient extra firm foam; Type HR-70 as sold by Fabric Supply Incorporated or by an equivalent product .

   1. Thickness for bench seat cushions: 4”
   2. Thickness for bench back and bench side cushions: 2”
   3. Shape: Square
   4. High-Resilient extra firm rating of IFD 70.
   5. Smoldering Resistance: Meet or exceed smoldering resistance as tested in accordance to California Technical Bulletin (TB) 117-2013.

B. Fabric hook and loop fastener tape:

   1. 1 inch wide strips of nylon fabric hook and loop fastener tape.

2.4 UPHOLSTERED BENCH SEAT, BACK AND SIDE CUSHION FABRICATION

A. Provide fully wrapped cushions with concealed sewn hems (no seam visible)

B. Machine Sew loop strips (of nylon fabric hook and loop fastener tap) at 12 inches O.C to bottom of upholstery bench seat cushion fabric and rear of bench back cushion fabric. Ends of loop strips shall be 2” from front and rear cushion edges.

PART 3 - EXECUTION

3.1 UPHOLSTERED SEAT CUSHION INSTALLATION

A. Install seat cushions by adhering/stapling the 1” fabric hook fastener tape to plywood bottom and back in spacing to match loop fastener tape of cushion upholstery covers

3.2 PROTECTION OF UPHOLSTERED SEAT CUSHIONS

1. Protect each individual bench seat and bench back cushion by wrapping with thick brown construction paper and store in secure, humidity and temperature controlled environment until last possible moment to be installed on day of Final CO.
2. Remove and replace seat cushions that are stained or soiled.

END OF SECTION 12 62 00.13

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PART 1 - GENERAL:

1.1 SCOPE OF WORK:

A. The work to be done under Division 21 contract shall include the furnishing of all labor, materials, equipment, and services necessary for and reasonably incidental to the proper completion of all work as shown on the plans and herein specified, excepting only work materials specified or noted as being furnished or installed by others.

B. All work shown in the drawings and specifications shall be included under the base bid, except where there is specific reference to exclusion and incorporation in other quotation.

C. The Fire Protection contractor may hereinafter also be referred to as "FPC", or Division 21 contractor.

D. Drawings shall not be scaled. Refer to architectural and structural drawings for building construction and dimensions and to room finish schedule or architectural drawings for material, finish and construction method of walls, floor and ceiling in order to insure proper rough-in and installation of work.

1.2 WORK INCLUDED:

A. The fire protection contractor shall be responsible for including the cost of all labor, accessories, tools, equipment and materials required to completely execute installation of the entire fire protection system as shown on the drawings and as specified. Work under the fire protection contract shall include, but shall not be limited to, the furnishing, unloading, handling, distribution, setting and installation of all components required for the following systems:

1. All interior wet sprinkler systems.
2. Dry pipe system for outdoor work area.
3. Sprinkler head locations as required per code.

1.3 RELATED WORK WHICH IS A PART OF SECTION 21 01 00

A. All work done under this section of the specification is subject to the Architect's instructions to bidders, general conditions and their corresponding supplements.

B. Refer to the supplementary general conditions of these specifications for temporary services and facilities that shall be provided.

1.4 DEFINITIONS:

A. "Piping": Pipe, fittings, flanges, valves, controls, hangers, traps, drains, insulation, vents, and items customarily required in connection with the transfer of fluids.

B. "Ductwork": All air delivery, recirculation and exhaust ducts, whether of sheet metal or other material, and includes all connections, accessories, and appurtenances necessary for and incidental to a complete system.

C. "Provide" (P): Furnish and install complete ready for use.

D. "Furnish" (F): Purchase and deliver to the project site complete with every necessary appurtenance and support.

E. "Install"(I): Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation of the proper location in the project.

F. "Concealed": Embedded in masonry or other construction, installed behind wall furring, within double piping off of all utilities shall be provided by the General Contractor.

G. "By Other Trades": Shall mean by persons or parties who are not anticipated to be the Contractor of this trade working together with the general contractor. In this context the words "by other trades" shall not be interpreted to mean not included in the overall contract.

1.5 INTERPRETATION OF CONTRACT DOCUMENTS:

A. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any item, in the drawings or specifications or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.

B. It shall be understood that the specifications and drawings are complementary and are to be taken together for a complete interpretation of the work. Exceptions are that notes on the drawings, which refer to an individual element of work, take precedence over the specifications where they conflict with same.

C. No exclusions from, or limitations in, the language used in the drawings or specifications shall be interpreted as meaning that the appurtenances or accessories necessary to complete any required system or item of equipment are to be omitted.

D. The drawings of necessity utilize symbols as schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended diagrammatic intent expressed on the drawings, and in conformity with the dimensions indicated on final architectural and structural working drawings and on equipment shop drawings.

E. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded.

F. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the intended work.

G. Information as to the general construction shall be derived from structural and architectural drawings and specification only.

H. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.

1.6 DELINEATION OF WORK:

A. The 21 contractors is required to supply all necessary supervision and coordination of information to any others who are performing work to accommodate the fire protection installation.

B. The specifications for the overall construction delineate various items of work under separate section headings. The list below set forth this delineation to the extent that it affects the fire protection work category. In the absence of more detailed information, this list shall be taken as a specific instruction to the fire protection contractor to include the work assigned to him. Indications that each contractor is to perform the work mean that it is to perform the work for its own accommodation only, except as specifically noted otherwise.

"P" indicates Provide
"F" indicates Furnish
"I" indicates Install

Item	"General"	"Plbg"	"Mech"	"FP"	Remarks
Fire protection				P	Refer to Section 21 01 04 & Electrical Dwg.
Wiring for fire protection equipment					Refer to Section 21 01 04 & Electrical Dwg.
Hoisting				P	
Rigging				P	
Cutting and Patching				P	

EXCEPTION: Cost where due to late installation or improper coordination of work is the responsibility of the delinquent contractor. Locations shall be approved by structural engineer.

For new construction, framed slots &openings in walls, decks & slabs	P				

EXCEPTION: Coordination drawings are required from fire protection contractor.

Sleeves through non-membraned slabs, decks and walls				P	

EXCEPTION: Refer to Division 3 for coordination of installation.

Sleeves through membraned slabs, decks and walls				P	

EXCEPTION: Refer to Division 3 for coordination of installation.

Fireproof sealing of excess opening in slabs, decks and fire rate walls				P	
Fastenings				P	
Supports				P	
Concrete foundations,				P	

"P" indicates Provide
"F" indicates Furnish
"I" indicates Install

Item	"General"	"Plbg"	"Mech"	"FP"	Remarks
pads & bases inside buildings					
Field touch-up painting damaged shop coats				P	
Finish painting of exposed work				P	
EXCEPTION: Painting of equipment, piping, etc. in mechanical spaces provided by fire protection contractor.					
Finished wall and ceiling access doors, panels and support frames				P	
Removal of spray on proofing from fire protection equipment	P				
Rubbish removal				P	
EXCEPTION: Where one trade furnishes and another installs, the installing trade removes the shipping and packing material which accumulate.					
Special tools for equipment maintenance				P	
Fire protection piping and associated work at 12" aff and interior to the building				P	

1.7 STANDARDS AND CODES:

A. Nothing in this specification shall be interpreted to conflict with any City or State law, regulation, code, ordinance, ruling or Fire Underwriters requirement applicable to this class of work.

B. All installations for construction purposes shall conform with the Department of Labor "Safety and Health Regulations for Construction."

C. All equipment with electrical components shall bear the UL label.

D. The following minimum standards apply wherever applicable:

1. ANS American National Standards
2. ASME American Society of Mechanical Engineers
3. ASTM American Society for Testing Materials
4. NEMA National Electrical Manufacturers Association
5. NFPA National Fire Protection Association
6. OSHA Occupational Safety and Health Act

1.8 INSPECTION AND COOPERATION:

A. All work shall be done under the periodic observation of and to the complete satisfaction of the Architect. No deviations from the Drawings and Specifications will be allowed without prior written approval of the Architect. The fire protection contractor shall each cooperate with the other contractors to allow for the installation of their work as well as his own.

B. The fire protection contractor shall be responsible for his work fitting in place without conflict with the other trades, where proper planning could avoid interference. Any work installed by this contractor without regard for other work, or if a conflict results, must be changed if directed by the Architect or Engineer without additional cost to Owner or his agents.

C. Relocation of equipment, system connections or rough-in locations up to ten feet (10'), if necessary, shall be done at no additional cost to the Owner or his agents if done before roughing-in.

D. All concealed work shall be inspected by the Architect or his appointed representative before being concealed. Fire protection contractor shall each call for inspection at least two (2) work days before concealment.

E. The Architect shall have the right to inspect the work whenever advisable in his judgment. The fire protection contractor shall have a representative present at each inspection and shall give such assistance as may be required.

F. Recommendations made by the Architect shall be promptly carried out and all unsatisfactory material and workmanship replaced at once to the Architect's satisfaction at the fire protection contractor expense.

G. The fire protection contractor shall be responsible for hoisting of all materials and equipment furnished under as part of his portion of the work in accordance with all City, State, and Federal rules and regulations.

1.9 TEMPORARY SERVICES AND FACILITIES:

A. Refer to general requirements for temporary services and facilities that shall be provided.

1.10 UNIT PRICES:

A. Refer to general requirements relative to "Add" or "Deduct" prices relative to this contract.

1.11 ROCK EXCAVATION UNIT PRICES

A. Refer to Section 01 22 00, as applicable.

1.12 SUBMITTALS:

A. LIST OF MANUFACTURERS: Within sixty days following award of contract, the fire protection contractor shall submit the required information pertaining to the equipment and materials he will be furnishing, commencing with the list of manufacturers for approval by the Engineer. Following up in short order shall be the shop drawings and other documents. The Owner and his representatives reserve the right to reject as unacceptable any items for which, in their judgment, they have not been allowed

adequate lead time in which to investigate suitability, or their experience has proved the service or equipment unsatisfactory.

B. SHOP DRAWINGS:

1. Prior to purchasing any equipment or materials, the approved list of the manufacturers shall be returned by the Engineer to the Contractor.

2. Contractor-reviewed and stamped "Approved" shop drawings shall be submitted conforming to the requirements stated in supplementary conditions and Division I for the items indicated throughout the following specifications:

3. Documents will not be accepted for approval unless:

   a. They comply with the requirements of the supplement to the General Conditions.

   b. They include complete information pertaining to appurtenances and accessories.

   c. They are submitted as a package where they pertain to related items.

   d. They are properly marked with service or function identification as related to the project, where they consist of catalog sheets displaying other items which are not applicable, and are marked with pertinent specification paragraph number.

   e. They are properly marked with external connection identification as related to the project where they consist of standard factory assembly or field installation drawings.

4. Approval of shop drawings does not invalidate the plans and specifications if in conflict, unless a letter requesting such change is submitted and approved on the Engineer's letterhead.

C. FABRICATION DRAWINGS: Prior to assembling or installing the work, the following shall be submitted to the Architect and the State Fire Marshal thirty days prior to approval by the fire protection contractor:

1. Scaled drawings indicating insert and sleeve locations.

2. Scaled drawings (1/4" or larger) showing dimensional locations in plan and elevation of all piping, sprinkler systems and equipment. Supervisor or foreman of the Plumbing, Mechanical and Electrical installing trade shall review drawings for coordination and initial each drawing he reviews.

3. The following general rules shall apply to the proceeding items:

   a. The sprinkler piping will generally be run at the lowest elevation possible in the ceiling. Pipes will be run dead level, without pockets, so the piping system is drainable. The Plumbing, Mechanical, Fire Protection, and Electrical Contractors shall exchange fabrication drawings and attend meetings to coordinate their work.

4. After fabrication drawings and flow calculations are reviewed and approved by the Engineer, the Engineer will send the fabrication drawings and flow calculation to the State for final review.

D. AS-BUILT DRAWINGS:

1. This contractor shall provide one set of marked plans to the Engineer for his preparation of as-built drawings. The marked plans shall indicate correct location of all equipment, piping, etc. as installed on project.

2. The drawings shall provide an accurate and complete record of the work as installed.

PART 2 - PRODUCTS:

2.1 MATERIALS AND MANUFACTURERS:

A. All equipment and materials required for installation under these specifications shall be new and without blemish or defect. All equipment shall bear labels attesting to Underwriter Laboratories approval where subject to Underwriters Laboratory label service. Where no specific indication as to the type of material or equipment is indicated a first class standard article shall be furnished.

B. Each major component of equipment shall have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable. ASME Code ratings, UL label, or other data which is die-stamped into the surface of the equipment shall be stamped in a location easily visible. It is the intent of the specifications that wherever manufacturers of a product are specified any substituted item must conform in all respects to the specified item. Consideration will not be given to claims that the substituted item meets the performance requirements with lesser construction such as lesser heat exchange surface, etc.).

C. Substituted equipment where permitted or approved, must conform to space requirements, whether approved or not or shall be replaced at the contractor's expense. Any modification of related systems as a result of substitutions shall be made at the contractor's expense.

D. Note the approval of shop drawings, or other information submitted in accordance with the requirements hereinbefore specified, does not assure that the Engineer, Architect, or any other Owner's Representative, attests to the dimensional accuracy or the ability of the material or equipment involved or the mechanical performance of the equipment. Approval of shop drawings does not invalidate the plans and specifications if in conflict, unless a letter requesting such change is submitted and approved on the Engineer's letterhead.

2.2 SUBSTITUTION OF SPECIFIED MATERIALS:

A. It is the purpose of this specification not to exclude competition between manufacturers of similar equipment.

B. Where items are specified as "or approved equivalent" prior approval must be obtained from the Engineer. Said approval does not intend to obligate the Engineer in the event shop drawings submitted do not indicate equality of materials, workmanship or function and the right to reject substitutes shall remain the prerogative of the Engineer.

C. In all cases regardless of method of submission, the contractor shall be completely responsible for changes in dimension of other than first named manufacturer equipment, electrical changes, etc. required for proper function and final performance. Item shall comply with all requirements herein set forth and as required to perform as designed. Minor modifications to suit standard manufactured items are acceptable if approved by Engineer.

D. Should contract documents fail to describe particular materials or goods to be used, then it shall be the duty of contractor to inquire of Engineer as to what is to be used and to supply it at contractor's expense or else thereafter or to require corrections.

E. The fire protection contractor shall promptly remove, at own expense, rejected materials from site of work.

F. When material has been approved, no change in brand or make will be permitted without approval of Engineer.

2.3 NAMEPLATES:

A. All items of operation equipment used on the project shall be provided with a nameplate mounted in a conspicuous place on the unit. Plate shall be embossed metal or stamped metal securely fastened to the unit.

B. The plate shall contain the following information:

1. Manufacturer's name and address.
2. All approval stamps, AGA, UL, Etc. as hereinafter specified.
3. Complete capacity and operating data as approved by Engineer
4. Motor Characteristics
5. Serial number and code numbers
6. Date of manufacture

PART 3 - EXECUTION:

3.1 WORKMANSHIP:

A. Workmanship shall be of best quality. Good appearance of finished work shall be of equal importance with its mechanical efficiency. No make-shifts shall be permitted anywhere in work and all portions work shall be so laid out and installed that work as a whole is of uniform quality and appearance.

3.2 PROTECTION OF EQUIPMENT:

A. Protect all materials and equipment from damage during storage at the site and throughout the construction period.

B. Protection from damage from rain, dirt, sun and ground water shall be accomplished by storing the equipment on elevated supports and covering them on all sides with protective rigid or flexible water proof coverings securely fastened.

C. Piping shall be protected by storing it on elevated supports and capping the ends with suitable material to prevent dirt accumulation in the piping.

D. The Division 21 contractor shall be responsible for the work damaged by him in executing this contract.

3.3 CONTIGUOUS WORK:

A. If any part of the Fire Protection contractors work is dependent for its proper execution or for its subsequent efficiency or appearance on the character or conditions of contiguous work not executed by him, the contractor shall examine and measure such contiguous work and report to the Architect in writing any imperfection therein, or conditions that render it unsuitable for the reception of this work. Should the Division 21 contractor proceed without making such written report, he shall be held to have accepted such work and the existing conditions and he shall be responsible.

3.4 CERTIFICATES OF INSPECTION AND APPROVAL:

A. Upon completion of work, the fire protection contractor shall furnish to the Owner certificates of inspection or approval from the authorities having jurisdiction if certificates of inspection or approval are required by law or regulation.

3.5 SLEEVES AND OPENINGS:

A. All sleeves and openings required shall be located and provided for by the Division 21 contractor for his portion of the work. Core drilling for missed sleeves shall be provided by this contractor.

B. In order to minimize liquid leakage or transfer of air between floors, it is the intent that pipe penetrations of floors (except in plumbing chases) be held to a minimum. Where it is necessary to penetrate floors, the pipe shall pass through sleeves set in the concrete, and the space between the pipe and sleeve shall be caulked to make it air tight.

3.6 ACCESS TO EQUIPMENT AND VALVES:

A. All control devices, specialties, valves and removable panels on equipment shall be so located as to provide easy access for inspection and maintenance, including removal of any interior components.

B. Should any work, such as piping, ducts, conduit, etc. be installed without due regard to the accessibility of devices installed by other contractors, the installation shall be relocated, offset or rerouted without cost to the Owner.

C. Where devices are to be concealed in walls or above nonremovable ceilings, this contractor shall provide the required access panels to the GC for installation for their respective equipment.

D. Size of panels shall be larger than the devices for accessibility and shall be 12" x 12" square for all wall panels and 24" x 24" for ceiling panels.

3.7 COORDINATION:

A. The fire protection contractor is cautioned that portions of the building has an unusually high quantity of piping, ducts, conduits, and other mechanical equipment, and space is limited. Offset pipes as required to avoid interference at no additional cost to the Owner. Generally pipes in which grade must be maintained, such as waste and storm drain piping, and sprinkler piping, shall have first priority. Other pipes shall be offset as

required to avoid those items. The mechanical contractor will be required to prepare coordinated shop drawings of the ductwork. The fire protection contractor will be furnished copies of these drawings and shall use them in determining pipe routing. Generally, service piping (water, gas, air, etc.) shall be run below ductwork to allow access to the piping. Where pipes of two trades conflict (e.g. domestic water pipe vs. chilled water pipe), generally the smaller pipe shall be offset.

B. The Mechanical contractor will make the basic duct drawings and send sepias to the fire protection contractor. Within 30 days after receiving the sepias, the fire protection contractor shall return them to the mechanical contractor, marked to show how fire protection pipes cross the ducts, and with suggested pipe elevation for each pipe. The mechanical contractor will use this information plus similar information received from other contractors to prepare the finished coordination drawings.

3.8 CHASES, CUTTING AND PATCHING:

A. In new construction, chases in walls for any work to be installed by this contractor will be provided by the general contractor provided full information as to the location and size of such chases and the necessary frames for openings is given to him by this contractor in such time as to cause no delay in the general contractor's work.

B. If this contractor should neglect to furnish the required information and by reason of his neglect chases and openings are not provided, he shall, at his own expense, cut the required chases and openings and make such repairs as shall be necessary to restore the work to its original finish.

C. The cutting of chases, openings, or holes in floors and ceilings shall be done in a manner as not to endanger the stability of the structure or any part thereof. This contractor shall not in any case cut or alter the work of any other contractor without the approval and under the direction of the Architect or Engineer. All repairs resulting from cutting shall be under the supervision of the Superintendent of the General Contractor.

END OF SECTION 21 01 00

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. This section delineates the DIVISION OF WORK between Division 21 and Division 26.

B. Specific work to be done under Division 26 is hereinafter listed or described. All other work necessary for the operation of Division 21 equipment shall be performed under Division 21.

1.2 DIVISION OF WORK:

A. All individual motor starters for fire protection equipment (pumps, etc.) shall be furnished and installed under Division 21 unless indicated as a part of a motor control center or designated "motor control trough". Motor starters provided in motor control centers and at motor control troughs shall be furnished under Division 26.

B. Under Division 26, power wiring rough-in shall be provided junction box, trough, starter or disconnect switch, as required by the specific piece of equipment. Equipment final connections shall be provided under Division 26.

C. All relays, flow switches, tamper switches and interlocking wiring, disconnect switches required by Division 21 equipment, and other appurtenances associated with equipment under Division 21 shall be furnished, installed and wired under Division 21.

D. All wiring required for controls and instrumentation not indicated on the drawings shall be furnished and installed by Division 21.

E. Additional power wiring required for fire protection equipment over and above what is shown on electrical drawings shall be provided under Division 21 work.

END OF SECTION 21 01 04

SECTION 21 02 08 - FIRE PROTECTION IDENTIFICATION AND PAINTING

PART 1 - GENERAL

1.1 SCOPE:

A. All exposed pipe, hangers, and equipment installed by this fire protection contractor shall be painted unless they have a factory finish or are noted otherwise. Exposed chromeplated brass, stainless steel, or plastic piping will not be painted.

B. Type of identification devices specified in this section include the following:
   1. Plastic Pipe Markers
   2. Plastic Tape
   3. Valve Tags
   4. Valve Schedule Frames
   5. Engraved Plastic-Laminate Signs

1.2 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. ANSI Standards: Comply with ANSI A13.1 for lettering size, colors, and viewing angles of identification devices.

1.3 SUBMITTALS:

A. Product Data: Submit product specifications and installation instructions for each identification material and device required.

B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.

C. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags," in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 01.

PART 2 - PRODUCTS:

2.1 PLASTIC PIPE MARKERS:

A. Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, color-coded, plastic-sheet pipe markers, complying with ANSI A13.1.

B. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:

   1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.

   2. Adhesive lap joint in pipe marker overlap.

3. Laminated or bonded application of pipe marker to pipe (or insulation).

C. Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:

1. Laminated or bonded application of pipe marker to pipe (or insulation).

2. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.

D. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.

E. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

2.2 PLASTIC TAPE:

A. Manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

B. Color: Comply with ANSI A13.1, except where another color selection is indicated.

2.3 VALVE TAGS: (PROVIDE ONE OF THE FOLLOWING):

A. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener. Provide 1-1/2" diameter tags, except as otherwise indicated.

B. Valve Tag Fasteners: Manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

2.4 VALVE SCHEDULE FRAMES:

A. For each page of the valve schedule, provide a glazed display frame, with screws for removable mounting on walls. Provide frames of rigid plastic or metal, with plastic glazing.

2.5 ENGRAVED PLASTIC-LAMINATE SIGNS:

A. Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.

C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.6 LETTERING AND GRAPHICS:

A. Coordinate names, abbreviations and other designations used in fire protection identification work with corresponding designations shown pre-existing, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer's or as required for proper identification and operation/maintenance of fire protection systems and equipment.

B. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples: Alarm Check Valve, etc.).

2.7 PAINT:

A. All products shall be in accordance with the specifications for painting in the general contract.

PART 3 - EXECUTION:

3.1 GENERAL:

A. Any equipment shipped with a factory applied finish shall be touched up to repair any damage to the finish so that it is the same as new.

B. In the mechanical equipment rooms the fire protection contractor shall be responsible for painting all piping, equipment, and accessories installed under their respective contract.

C. In other parts of the buildings items which are in place in finished areas when general building painting is done will be painted by the General Contractor. Items installed after painting is completed shall be painted by the fire protection contractor, as directed by the architect.

D. All nongalvanized ferrous metal hangers and miscellaneous metal used in connection with the fire protection system shall be painted with two coats of enamel.

E. Do not field paint exposed copper pipe, brass valves, or brass trim on iron body valves, or machinery or equipment that has a factory applied finish unless otherwise specified. Do not paint plastic pipe.

F. All paint shall be delivered to the project in unbroken containers. Containers shall be labeled to indicate color, directions for use, manufacture, and date of manufacturer. Directions for use of the paint shall be carefully followed in the mixing and general application. All paint shall be applied under dry and dust free conditions. Sufficient time shall elapse between paint coats to permit satisfactory recoating. Once started all painting shall be completed without delay.

3.2 PIPING SYSTEM IDENTIFICATION:

A. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums), exterior non-concealed locations and above removable acoustical ceilings.

1. Near each valve and control device.

2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.

3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.

4. At access doors, manholes and similar access points which permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.

7. On piping above removable acoustical ceilings.

3.3 PAINT SCHEDULE:

A. All exposed equipment, pipes, conduits, or other appurtenances shall be painted by this contractor with materials and application as specified in the general contract specifications and as directed by the architect.

B. All concealed pipe covering shall be identified by colored bands and legends. The direction of flow shall be indicated by flow arrows.

C. All exposed pipe covering shall be totally painted the color of the band color listed below. All exposed pipe hangers, rods, supports, channels, etc. shall be painted flat black.

D. Color coding strips shall be painted no less than every 15 linear feet plus wherever entering or leaving a space and near valves. (Tape is acceptable). Width of strip shall be approximately 1/5 of the diameter of pipe plus covering if any, but in no case less than 1/2 inch. Color coding shall conform OSHA requirement.

E. Directions arrow and fluid name shall be applied by sticker at same spacing as above. The stickers shall be secured by color coded tape wrapped two times around the pipe at each end of the label or spring cords.

F. Standard colors and legends are as follows: (Fire Protection)

PIPING SYSTEM	SHERWIN WILLIAMS COLOR # REF.	STENCIL COLORIDENTIFICATION
Sprinkler	Safety Red	SPKR
Fire Line	Safety Red	FIRE
Supports, Hangers	Black	

G. Pipe identification should contrast in color to the pipe colors and be easily readable. The width of color bands should be equal to the size of the stencil indicated below.

1. For insulated pipe systems, stencil sizes should be as follows:

   a. For pipes up to 1", use 1" letters
   b. For pipes 1" to 2", use 2" letters

c. For pipes 2" to 6", use 3" letters
d. For pipes above 6", use 4" letters

2. For uninsulated systems, stencil sizes should be as follows:

a. For pipe diameters up to 1", use 1/2" letters
b. For pipe diameters from 1" to 2", use 1" letters
c. For pipe diameters from 2" to 6", use 2" letters
d. For pipe diameters over 6", use 3" letters

END OF SECTION 21 02 08

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Provide all concrete and masonry work as indicated on the fire protection contract drawings, unless it is indicated that it will be by the general contractor. This includes bases for equipment.

PART 2 - PRODUCTS

2.1 GENERAL

A. All cement, gravel, sand, reinforcing rod, brick, block and other materials comply with the requirements for those materials in the specifications for the general contractor.

PART 3 - EXECUTION

3.1 GENERAL

A. The workmanship and manner of placing the materials shall comply with the requirements for those items in the specifications for the general contract.

B. Bases shall have smooth tops and cambered edges.

END OF SECTION 21 02 10

PART 1 - GENERAL

1.1 DEFINITION:

A. Work under this section of the specifications shall include but not necessarily be limited to items common to sections:

1. 21 05 30 – Sprinkler Systems

B. In all cases, work specified in this section of the specifications shall be compatible with the above listed specification sections and the requirements of the State of North Carolina.

1.2 SUBMITTALS:

A. Shop drawings and system alarm diagrams shall be submitted on all items in accordance with the provisions of Specification Section 21 01 00.

B. Submit shop drawings on the following.

1. Piping materials
2. Water flow indicators
3. Sprinkler heads
4. Valves

C. The contract drawings show the general arrangement of the areas to receive fire protection. The fire protection subcontractor shall review the drawings so that all items that will affect the operation of the fire protection system (such as fire detection equipment, air diffuser openings, door openings, lights, fire and smoke dampers, etc) are considered in the design of the system. The shop drawings and associated hydraulic calculations required by the fire protection subcontractor shall be prepared by a NICET level 3 designer using a computer program for sizing of pipes, etc.

1.3 COORDINATION:

A. This subcontractor shall coordinate with the other contractors as required to produce workable, controllable systems. Generally, all controls and equipment shall be furnished and installed by this contractor unless otherwise noted. This contractor shall be licensed for sprinkler work. Specific examples of coordination and cooperation include:

B. Tie-ins to systems provided under separate contract and all required auxiliary devices shall be provided by this subcontractor.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION:

3.1 FIRE SPRINKLER PIPING SYSTEMS:

A. Comply with requirements of ANSI/NFPA 13, 2013 edition, for installation of fire sprinkler piping materials. Install fire sprinkler piping products where indicated, in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that fire sprinkler piping complies with requirements and serves intended purposes.

B. Coordinate with other work, including plumbing piping, as necessary to interface components of fire sprinkler piping properly with other work.

C. Install sectional valves in inlet piping at bottom of each riser and in loops as indicated.

D. Mount supervisory switches on each sectional valve.

E. Install valved hose connections of sizes indicated, or 3/4" size if not otherwise indicated, on sprinkler at ends of branch lines and cross mains at locations where required.

F. Install drain piping at low points of fire sprinkler piping.

3.2 ADJUST AND CLEAN:

A. Sprinkler Piping Flushing: Prior to connecting sprinkler risers for flushing, flush water feed mains, lead-in connections and control portions of sprinkler piping. After fire sprinkler piping installation has been completed and before piping is placed in service, flush entire sprinkler system, as required to remove foreign substances, under pressure as specified in ANSI/NFPA 13. Continue flushing until water is clear, and check to ensure that debris has not clogged sprinklers.

B. The sprinkler sub-contractor is responsible for all piping starting 12” above the finished floor. The site contractor is responsible for cleaning and testing the piping underground up to where he stubs it 12” above the floor. The site contractor shall provide the sprinkler contractor with a “Material and Test Certificate for Underground Piping”.

3.3 FIELD QUALITY CONTROL:

A. Hydrostatic Testing: After flushing system, test fire sprinkler piping hydrostatically, for period of 2 hours, at not less than 200 psi or at 50 psi in excess of maximum static pressure when maximum static pressure is in excess of 150 psi. Check system for leakage of joints. Measure hydrostatic pressure at low point of each system or zone being tested.

B. Repair or replace piping system as required to eliminate leakage in accordance with ANSI/NFPA standards for "little or no leakage," and retest as specified to demonstrate compliance.

3.4 EXTRA STOCK:

A. General: For each style and temperature range required, furnish additional sprinkler heads, in cabinet according to NFPA 13.

END OF SECTION 21 05 00

PART 1 - GENERAL

1.1 SCOPE:

A. This work shall consist of furnishing all labor, material, equipment and services necessary for the installation of all equipment specified hereinafter.

B. Systems, piping and components principally relevant to this section include:

1. Water Flow Indicators
2. Pipe and Fittings
3. Valves

1.2 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in the manufacture of fire sprinklers and piping accessories of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. NFPA Code:

1. Comply with NFPA No. 13, "Standard for the Installation of Sprinkler System".

C. FM Compliance:

1. Comply with Factory Mutual "Approved Guide."
2. FM Labels: Provide sprinkler products bearing FM approval labels.

D. UL Labels: Provide fire sprinkler piping products which have been approved and labeled by Underwriters Laboratories.

E. Local Fire Department/Marshall Regulations: Comply with governing regulations pertaining to fire sprinkler piping.

PART 2 - PRODUCTS:

2.1 FIRE DEPARTMENT VALVES:

A. 2-1/2" angle valve shall be cadmium plated complete with 300# rough brass body, wheel handle, cap and chain, and escutcheon plate.

2.2 SPRINKLER HEADS:

A. Heads shall be upright, pendant, recessed, or concealed as indicated on the plans and as required for duty performed, and of ordinary degree rating unless otherwise noted.

2.3 WATER FLOW INDICATORS:

A. Flow indicators shall be provided where shown on the drawings and designed to operate either on drop in pressure or water flow. They must operate reliably on any flow of water amounting to 10 gallons or more per minute, and shall not be subject to false alarms due to water hammer or sudden increase in pressure. A retard element shall be provided, adjustable up to approximately 60 seconds delay. All working parts shall be of corrosion resisting metal. Flow indicators shall be suitable for 175 psi water working pressure and provided with electrical contact unit such as to perform the functions described.

2.4 PIPE AND FITTINGS:

A. Piping shall be Schedule 10, lightwall for sizes 2-1/2" and larger. Piping shall be Schedule 40 for sizes 1" through 2". Fittings shall be black cast iron, Class A. Drain piping above ground shall be galvanized. Piping and fittings subjected to pressures over 175 psi shall be rated at 250 psi.

2.5 VALVES:

A. All valves shall be butterfly type rated suitable for 175 psi working water pressure.

B. Riser and sectional control valves shall be butterfly type with integral tamper. Each tamper switch shall be wired to supervisory panel by Electrical Contractor.

C. Drainage and test valves shall be all-bronze, ball or globe type with screw ends.

D. Check valves 2 inch and smaller shall be all bronze with screw ends. Check valves 2-1/2 inch and larger iron body, brass mounted with flange ends and non-ferrous metal seat rings and bearings.

PART 3 - EXECUTION:

3.1 TESTING:

A. Sprinkler system shall be tested and proved tight under 200 PSI water pressure. All leaks shall be made tight by natural means. No caulking shall be allowed. Contractor shall furnish, connect and operate pump required for testing and shall bear all other expense of tests. The above tests shall be made before painting is done and prior to installation of finished ceilings in areas where pipe is installed above ceiling. This test shall be made prior to making request for final inspection by the Architect. Copies of standard Contractor's Certificate of Test and Material shall be furnished to both the insurance underwriters and the Architect.

3.2 INSTALLATION OF PIPING:

A. Sprinkler piping shall be installed in strict accordance with NFPA, latest standard.

3.3 VALVES:

A. Valves shall be installed at all points noted on drawings by standard symbols or as required by best general practice for proper control and operation of the system.

END OF SECTION 21 05 30

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section describes the requirements for testing and balancing of all piping and equipment installed under this contract in the presence of the Engineer and the proper Fire Protection Inspector and prove tight for the periods stated below or longer if required for inspection.

B. Test in section if deemed advisable.

C. Disconnect the apparatus for developing the required pressures during the stated periods.

D. Completely disconnect and remake joints that leak.

E. No fire protection system or part thereof shall be covered or concealed until after it has been tested and approved.

F. If such work has been covered or concealed before testing, it shall be exposed for testing.

G. If tests described in the specifications for fire protection systems differ from requirements or the local inspector, the more rigid requirements shall govern.

PART 2 - PRODUCTS

2.1 SPRINKLER SYSTEM:

A. Fill and subject to 200 PSIG hydrostatic pressure at the lowest level for (2) hours.

END OF SECTION 21 05 93

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. The work to be done under Division 22 contract shall include the furnishing of all labor, materials, equipment, and services necessary for and reasonably incidental to the proper completion of all work as shown on the plans and herein specified, excepting only work materials specified or noted as being furnished or installed by others.

B. All work shown in the drawings and specifications shall be included under the base bid, except where there is specific reference to exclusion and incorporation in other quotation.

C. The Plumbing contractor may hereinafter also be referred to as "This contractor," "PC", or Division 22 contractor.

D. Drawings shall not be scaled. Refer to architectural and structural drawings for building construction and dimensions and to room finish schedule or architectural drawings for material, finish and construction method of walls, floor and ceiling in order to insure proper rough-in and installation of work.

1.2 WORK INCLUDED:

A. The plumbing contractor shall be responsible for including the cost of all labor, accessories, tools, equipment and materials required to completely execute installation of the entire plumbing systems as shown on the drawings and as specified. Work under the plumbing contract shall include, but shall not be limited to, the furnishing, unloading, handling, distribution, setting and installation of all components required for the following systems:

1. Water service (interior and exterior to a point 5'-0" outside the building).
2. Sanitary sewers (interior and exterior to a point 5'-0" outside the building).
3. Laboratory gas piping systems
4. Hot and cold domestic water systems.
5. Piping Specialties.
6. Insulation on plumbing systems.
7. Storm sewer (interior and exterior to a point 5'-0" outside the building).
8. Plumbing fixtures.
9. Rough-in and final connections.
10. Miscellaneous items as specified, required and/or shown on drawings.
11. All vents, safety valves, vacuum breakers, drain and piping systems as required.
12. Natural gas piping.

1.3 RELATED WORK WHICH IS A PART OF SECTION 22 01 00:

A. All work done under this section of the specification is subject to the Architect's instructions to bidders, general conditions and their corresponding supplements.

B. Refer to the supplementary general conditions of these specifications for temporary services and facilities that shall be provided.

1.4 DEFINITIONS:

A. "Piping": Pipe, fittings, flanges, valves, controls, hangers, traps, drains, insulation, vents, and items customarily required in connection with the transfer of fluids.

B. "Ductwork": All air delivery, recirculation and exhaust ducts, whether of sheet metal or other material, and includes all connections, accessories, and appurtenances necessary for and incidental to a complete system.

C. "Provide" (P): Furnish and install complete ready for use.

D. "Furnish" (F): Purchase and deliver to the project site complete with every necessary appurtenance and support.

E. "Install"(I): Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation of the proper location in the project.

F. "Concealed": Embedded in masonry or other construction, installed behind wall furring, within double partitions of hung ceilings, in crawl spaces, in shafts.

G. "By Other Trades": Shall mean by persons or parties who are not anticipated to be the Plumbing Contractor this trade working together with the general contractor. In this context the words "by other trades" shall not be interpreted to mean not included in the overall contract.

1.5 ABBREVIATIONS:

A.	AD	Access Door
B.	AFF	Above Finish Floor
C.	AMP	Amperes
D.	AP	Access Panel
E.	AV	Air Vent
F.	BWV	Back Water Valve
G.	BO	By Others
H.	C	Conduit
I.	CAB	Cabinet
J.	CB	Catch Basin
K.	CI	Cast Iron
L.	CL	Ceiling
M.	CO	Clean Out (F-Floor)(W-Wall(Y-Yard)
N.	CONTR	Contractor
O.	CP	Circulating Pump
P.	DB	Decibels
Q.	DIS.SW	Disconnect Switch
R.	DN	Down
S.	ELEC	Electrical
T.	FD	Floor Drain
U.	FL	Floor
V.	HB	Hose Bibb
W.	I	Install
X.	IE	Invert Elevation
Y.	MH	Manhole
Z.	NC	Noise Criteria
AA.	P	Provided (Furnished & Installed
BB.	PLBG	Plumbing

CC.	UF	Underfloor
DD.	UG	Underground
EE.	VCP	Vitrified Clay Tile Pipe
FF.	WC	Water Closet
GG.	Ø or PH	Current Phase

1.6 INTERPRETATION OF CONTRACT DOCUMENTS:

A. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any item, in the drawings or specifications or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.

B. It shall be understood that the specifications and drawings are complementary and are to be taken together for a complete interpretation of the work. Exceptions are that notes on the drawings, which refer to a specific element of work, take precedence over the specifications where they may conflict.

C. No exclusions from, or limitations in, the language used in the drawings or specifications shall be interpreted as meaning that the appurtenances or accessories necessary to complete any required system or item of equipment are to be omitted.

D. The drawings of necessity utilize symbols as schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed in accordance with the diagrammatic intent expressed on the drawings, and in conformity with the dimensions indicated on final architectural and structural working drawings and on equipment shop drawings.

E. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded.

F. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the intended work.

G. Information as to the general construction shall be derived from structural and architectural drawings and specification only.

H. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.

1.7 DELINEATION OF WORK:

A. The plumbing contractor is required to supply all necessary supervision and coordination of information to any others who are performing work to accommodate plumbing installations. Where the plumbing contractor is required to install items which he does not purchase, he shall include for such items:

1. The coordination of their delivery.
2. Their unloading from delivery trucks driven in to any designated point on the property line.

3. Their safe handling and field storage up to the time of permanent placement in the project.
4. The correction of any damage, defacement or corrosion to which they may have been subjected.
5. Their field assembly and internal connections as may be necessary for their proper operation.
6. Their mounting in place including the purchase and installation of all dunnage supporting members and fastenings necessary to adapt them to architectural and structural conditions.
7. Their connection to building systems including the purchase and installation of all terminating fittings necessary to adapt and connect them to the building systems.

B. Items which are to be installed but not purchased as part of the work of the plumbing contractor shall be carefully examined upon delivery to the project. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of the work will be considered only if presented in writing within one week of the date of delivery to the project of the items in question. The work under this contract shall include all procedures, regardless of how extensive, necessary to put into satisfactory operation, all items for which no claims have been submitted as outlined above.

C. The specifications for the overall construction delineate various items of work under separate section headings. The list below set forth this delineation to the extent that it affects the plumbing work category. In the absence of more detailed information, this list shall be taken as a specific instruction to the plumbing contractor to include the work assigned to him. Indications that each contractor is to perform the work means that it is to perform the work for its own accommodation only, except as specifically noted otherwise.

1. "P" indicates Provide
2. "F" indicates Furnish
3. "I" indicates Install

Item	"General"	"Plbg"	"HVAC"
Motors for plumbing equipment		P	
Motor controls for plumbing equipment	Refer to motor control schedules.		
Power wiring for plumbing equipment EXCEPTION: Refer to notes on drawings.	Refer to Section 22 01 04		
Hoisting		P	
Rigging		P	
Cutting and Patching		P	

EXCEPTION: Cost where due to late installation or improper coordination of work is the responsibility of the delinquent contractor. Locations shall be approved by structural engineer.

Framed slots and openings in walls, decks and slabs		P	

Item	"General"	"Plbg"	"HVAC"
EXCEPTION: Coordination drawings are required from plumbing contractor.			
Sleeves through non-membraned slabs, decks and walls		P	
EXCEPTION: Refer to Division 03 00 00 for coordination of installation.			
Removal of and repaving of existing sidewalks, roads, etc. resulting from modification and new mech. utilities	P		
EXCEPTION: Refer to Division 31 00 00 for additional requirements.			
Sleeves through membraned slabs, decks and walls		P	
EXCEPTION: Refer to Division 03 00 00 for coordination of installation.			
Fireproof sealing of excess opening in slabs, decks and fire rate walls		P	
Excavation and backfill of trenches inside building		P	
EXCEPTION: Specifications and drawings delineate exceptions.			
Blasting		P	
EXCEPTION: Only with permission of Architect.			
Keeping trench excavations free from water during construction		P	
EXCEPTION: The general contractor shall be responsible for keeping the entire site free from surface water.			
Fastenings		P	
Supports		P	
Concrete foundations, pads and bases inside buildings		P	
Field touch-up painting damaged shop coats		P	
Finish painting of exposed work		P	
EXCEPTION: Painting of equipment, piping etc. in mechanical spaces provided by plumbing contractor. The plumbing contractor shall prime all exposed piping, etc. in finished spaces.			
Finished wall and ceiling access doors, panels & support frames	I	F	

Item	"General"	"Plbg"	"HVAC"
EXCEPTION: Plumbing contractor shall supply and locate all required access doors to the installing trade.			
Domestic make-up water piping for heating and air conditioning system	_____	P	_____
EXCEPTION: Final connection provided by HVAC contractor.			
Removal of spray on fire proofing from plumbing equipment, hangers, etc.	P	_____	_____
Rubbish Removal	_____	P	_____
EXCEPTION: Where one trade furnishes and another installs, the installing trade shall remove the shipping and packing material which accumulate.			
Special tools for equipment maintenance	_____	P	_____
Piping and associated work outside of the building line	_____	P	_____
EXCEPTION: Rough-in and final connection shall be provided by the plumbing contractor providing specified services.			

D. This plumbing contractor is required to supply all necessary supervision and coordination of information to any others who are supplying work to accommodate his installation.

1.8 STANDARDS AND CODES:

A. Nothing in this specification shall be interpreted to conflict with any City or State law, regulation, code, ordinance, ruling or Fire Underwriters requirement applicable to this class of work.

B. All installations for construction purposes shall conform with the Department of Labor "Safety and Health Regulations for Construction."

C. All equipment with electrical components shall bear the UL label.

D. The following minimum standards apply wherever applicable:

1.	ANS	American National Standards
2.	ASTM	American Society for Testing Materials
3.	NEMA	National Electrical Manufacturers Association
4.	NFPA	National Fire Protection Association
5.	OSHA	Occupational Safety and Health Act
6.	AGA	American Gas Association
7.	ASA	American Standards Association
8.	AWWA	American Water Works Association
9.	CISPI	Cast Iron Soil Pipe Institute
10.	NBFU	National Board of Fire Underwriters

11. PDI Plumbing and Drainage Institute

1.9 INSPECTION AND COOPERATION:

A. All work shall be done under the periodic observation of and to the complete satisfaction of the Architect. No deviations from the Drawings and Specifications will be allowed without prior written approval of the Architect. The plumbing contractor shall cooperate with the other contractors to allow for the installation of their work as well as his own.

B. The plumbing contractor shall be responsible for his work fitting in place without conflict with the other trades, where proper planning could avoid interference. Any work installed by this contractor without regard for other work, or if a conflict results, must be changed if directed by the Architect or Engineer without additional cost to Owner or his agents.

C. Relocation of equipment, piping, system connections or rough-in locations up to ten feet (10') in any direction, if necessary, shall be done at no additional cost to the Owner or his agents upon notification, or as determined by the preparation of fabrication or coordinated shop drawings, prior to installation.

D. All concealed work shall be inspected by the Architect or his appointed representative before being concealed. Plumbing Contractor shall call for inspection at least two (2) work days before concealment.

E. The Architect shall have the right to inspect the work whenever advisable in his judgment. The plumbing contractor shall have a representative present at each inspection and shall give such assistance as may be required.

F. Recommendations made by the Architect shall be promptly carried out and all unsatisfactory material and workmanship replaced at once to the Architect's satisfaction at the contractor's expense.

G. The plumbing contractor shall be responsible for hoisting of all materials and equipment furnished under as part of his portion of the work in accordance with all State, and Federal rules and regulations.

1.10 TEMPORARY SERVICES AND FACILITIES:

A. Refer to general requirements for temporary services and facilities that shall be provided.

1.11 UNIT PRICES:

A. Refer to general requirements relative to "Add" or "Deduct" prices relative to this contract.

1.12 ROCK DEFINITION:

A. Refer to Division 31for definitions and requirements relative to rock encountered during excavation.

1.13 SUBMITTALS:

A. LIST OF MANUFACTURERS: Within twenty days following award of contract, the plumbing contractor shall submit the required information pertaining to the equipment and materials he will be furnishing, commencing with the list of manufacturers for approval by the engineer. Following up in short order shall be the shop drawings and other documents. The Owner and his representatives reserve the right to reject as unacceptable any items for which, in their judgment, they have not been allowed adequate lead time in which to investigate suitability, or their experience has proved the service or equipment unsatisfactory.

Section	Item	Manufacturers		
220204	Motors	Westinghouse	Wagner	Gould Century
220208	Identification	Seton	Calpico	SSC
220510	Pipe	Republic Steel	National Tube	Youngstown
220510	Fittings	Tube-Turn	Grinnell	Ladish
220510	Vacuum Breakers	Bidero	Watts	Wilkens
220510	Pipe Thread Compound	Crane	Dixon	Rutland
220512	Sleeves	Pipe Shields	R&S Mfg	Clow
220512	Hangers	Modern	F&S	Grinnell
220512	Escutcheon	U.S. Brass	Brass Craft	Central Brass
220512	Fire Sealant	ChaseFoam	3M	Proset
220512	Access Doors	Milcor	Acorn	Sioux Chief
220512	Pipe Supplies	F&S	F&M	Grinnell
220512	Hot Water Expansion Tank	Wessels	Amtrol	B&G
220512	Reduced Pressure Backflow Preventer	Wilkins	Watts	Febco
220512	Thermostatic Mixing Valve	Lawler	Powers	Leonard
220523	Valves	Apollo	Jenkins	Fairbanks
220523	Circuit Setters	B&G	Taco	Thrush
220523	Butterfly Valves	Apollo	Monarch	Dover
220523	Silent Check Valves	Apollo	Watts	Ames
220523	Gravity Flow Check Valves	B & G	Taco	Armstrong
220548	Seismic Restraints	Mason	Grinnell	Uni-Strut
220700	Insulation	Certainteed	Owens-Corning	Knauff

Section	Item	Manufacturers		
220700	Insulation Mastic	Benjamin & Foster	Armstrong	3M
221301	Thermometers	Weksler	Palmer	Trerice
221301	Pressure Gauges	Ashcroft	Palmer	Trerice
222113	Specialties	B&G	Taco	Armstrong
222113	Unions	Grinnell	Watts	Wilkens
222113	Safety Valves	Lonegran	Kunkle	Crane
222113	Strainers	Watts	Febco	Hammond
223300	Domestic Water Heater	Rheem	Lochinar	A.O Smith
224000	Plumbing Fixtures	Toto	Kohler	American Standard
224000	Plumbing Trim	Delta	Kohler	T & S Brass
224000	Flush Valves	Toto	Sloan Royal Co.	Zurn
224000	Fixture Seats	Bemis Mfg. Co.	Kohler	Olsonite
224000	Water Coolers	Elkay	Haws	Sunroc Corp.
224000	Stainless Steel Sinks	Elkay Mfg.	Just Mfg.	Kohler
224000	Fixture Carriers	Josam Mfg.	Zurn	Wade

1.14 SHOP DRAWINGS:

A. Prior to purchasing any equipment or materials, the approved list of the manufacturers shall be returned by the Engineer to the plumbing contractor.

B. Shop drawings shall be submitted conforming to the requirements stated in supplementary conditions and Division 01 for the items indicated throughout the following specifications:

C. Documents will not be accepted for approval unless:

1. They comply with the requirements of the supplement to the General Conditions.
2. They include complete information pertaining to appurtenances and accessories.
3. They are submitted as a package where they pertain to related items.
4. They are properly marked with service or function identification as related to the project, where they consist of catalog sheets displaying other items which are not applicable, and are marked with pertinent specification paragraph number.
5. They are properly marked with external connection identification as related to the project where they consist of standard factory assembly or field installation drawings.

6. The submittal is stamped approved by the Plumbing contractor and contain no other markings.
7. Approval of shop drawings does not invalidate the plans and specifications if in conflict, unless a letter requesting such change is submitted and approved on the Engineer's letterhead.

1.15 FABRICATION DRAWINGS:

A. Prior to assembling or installing the work, the following shall be submitted to the Architect by the plumbing contractor:

1. Scaled drawings indicating insert and sleeve locations. The background shall include the structural framing plan.
2. Scaled drawings (1/4" or larger) showing dimensional locations in plan and elevation of all piping, conduit, sprinkler systems, ductwork, lighting fixtures, structure, and equipment. Supervisor or foreman of the Plumbing, Mechanical and Electrical installing trade shall review drawings for coordination and initial each (as a sign of approval) drawing he reviews.
3. Scaled drawings (1/4" or larger) showing dimensional locations in plan and elevation of all piping, ductwork and equipment in equipment rooms.

B. The following general rules shall apply to the proceeding items:

1. The sprinkler piping will generally be run dead level, without pockets, so the piping system is drainable. The plumbing contractor shall be furnished copies of and a "CADD disk" of the Fire Protection shop drawings from his subcontractor for use in preparing the coordinated duct drawings.
2. Storm drain piping and sanitary waste piping, in which the grade must be maintained, shall have first priority. Ducts and other pipes shall be offset to avoid them.
3. Service piping (water, gas, air, ultrapure water, etc.) shall generally be run below ductwork so they will be accessible for service and modifications. The pipes will be offset as required to avoid interfering with access to duct access to duct access panels, dampers, etc.
4. Ducts will have next priority. Ducts will be offset as required to avoid pipes.
5. Where pipes of different trades conflict, such as domestic water vs. chilled water, the smaller pipe shall be offset.
6. Plumbing Contractor shall make field water, waste and vent riser isometrics as required to comply with local code interpretations as herein stated or as required by local authorities having jurisdiction if not compatible with bid documents.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials used in this work shall be new unless otherwise noted. All materials used on this project shall be listed and labeled by one of the third party agencies which have been approved by the U.L. building authority housing jurisdiction to safety test and label electrical and mechanical equipment. Any material installed that is not labeled shall be subject to a field evaluation by one of these approved agencies, at the contractor’s expense, if requested by the authority having jurisdiction or the engineer. Any item not approved by the agency shall be replaced by the contractor at his expense. It shall be the contractor’s responsibility to verify that materials specified or used on the project are labeled.

2.2 MATERIALS AND MANUFACTURERS:

A. All equipment and materials required for installation under these specifications shall be new manufactured and without blemish or defect. All equipment shall bear labels attesting to Underwriter Laboratories approval where subject to Underwriters Laboratory label service. Where no specific indication as to the type of material or equipment is indicated a first class standard article shall be furnished.

B. Each major component of equipment shall have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable. ASME Code ratings, UL label, or other data which is die-stamped into the surface of the equipment shall be stamped in a location easily visible. It is the intent of the specifications that wherever manufacturers of a product are specified any substituted item must conform in all respects to the specified item. Consideration will not be given to claims that the substituted item meets the performance requirements with lesser construction such as lesser heat exchange surface, etc.). Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance. In many cases equipment is oversized to allow for pick-up loads which cannot be delineated under the minimum performance.

C. Substituted equipment where permitted or approved, must conform to space requirements, whether approved or not or shall be replaced at the plumbing contractor's expense. Any modification of related systems as a result of substitutions shall be made at the plumbing contractor's expense.

D. Note the approval of shop drawings, or other information submitted in accordance with the requirements hereinbefore specified, does not assure that the Engineer, Architect, or any other Owner's Representative, attests to the dimensional accuracy or the ability of the material or equipment involved or the mechanical performance of the equipment.

2.3 SUBSTITUTION OF SPECIFIED MATERIALS:

A. It is the purpose of this specification not to exclude competition between manufacturers of similar equipment.

B. Where items are specified as "or approved equivalent" prior approval must be obtained from the Engineer. Said approval does not intend to obligate the Engineer in the event shop drawings submitted do not indicate equality of materials, workmanship or function and the right to reject substitutes shall remain the prerogative of the Engineer.

C. In all cases regardless of method of submission, the plumbing contractor shall be completely responsible for changes in dimension of other than first named manufacturer equipment, electrical changes, etc. required for proper function and final performance. Item shall comply with all requirements herein set forth and as required to perform as designed. Minor modifications to suit standard manufactured items are acceptable if approved by Engineer.

D. Should contract documents fail to describe particular materials or goods to be used, then it shall be the duty of plumbing contractor to inquire of Engineer as to what is to be used and to supply it at plumbing contractor's expense.

E. Plumbing Contractor shall promptly remove, at own expense, rejected materials from site of work.

F. When material has been approved, no change in brand or make will be permitted without approval of Engineer.

2.4 NAMEPLATES:

A. All items of operation equipment used on the project shall be provided with a nameplate mounted in a conspicuous place on the unit. Plate shall be embossed metal or stamped metal securely fastened to the unit.

B. The plate shall contain the following information:

1. Manufacturer's name and address.
2. All approval stamps, AGA, UL, Etc. as hereinafter specified.
3. Complete capacity and operating data as approved by Engineer
4. Motor Characteristics
5. Serial number and code numbers
6. Date of manufacturer

2.5 RECORD DRAWINGS:

A. Purchase and maintain at the job site a complete and separate set of prints of the approved working Drawings on which to accurately indicate daily progress by coloring materials and apparatus as installed. Schedules shall be modified to reflect data consistent with that of the installed equipment. Clearly show all changes to the work as a result of change orders, instruction issued by the Architect or conditions encountered in the field. Accurately indicate the location, size, type and elevation of new utilities and their relationship to existing utilities.

B. The marked-up and colored-in prints will be used as a guide for determining the progress of the work installed. They shall be inspected at the architect's discretion and shall be corrected immediately if found inaccurate or incomplete. Requisitions for payment may not be approved until the drawings are accurate and up-to-date.

C. The plumbing contractor shall provide one set of marked plans to the Engineer for his review and approval of record drawings. The approved plans shall be returned to the contractor for his CADD preparation of documents using version 12 to indicate correct location of all equipment, piping, etc. as installed on project.

D. The drawings shall provide an accurate and complete record of the work as installed.

PART 3 - EXECUTION

3.1 WORKMANSHIP:

A. Workmanship shall be of best quality. Good appearance of finished work shall be of equal importance with its mechanical efficiency. No make-shifts shall be permitted anywhere in work and all portions of work shall be so laid out and installed that work as a whole is of uniform quality and appearance.

3.2 PROTECTION OF EQUIPMENT:

A. Protect all materials and equipment from damage during storage at the site and throughout the construction period.

B. Protection from damage from rain, dirt, sun and ground water shall be accomplished by storing the equipment on elevated supports and covering them on all sides with protective rigid or flexible water proof coverings securely fastened.

C. Piping shall be protected by storing it on elevated supports and capping the ends with suitable material to prevent dirt accumulation in the piping.

D. The plumbing contractor shall be responsible for the work damaged by him in executing this contract. Any work damaged by the plumbing contractor shall be replaced by him and placed in perfect condition without extra cost.

3.3 CONTIGUOUS WORK:

A. If any part of the plumbing contractor's work is dependent for its proper execution or for its subsequent efficiency or appearance on the character or conditions of contiguous work not executed by him, the contractor shall examine and measure such contiguous work and report to the Architect in writing any imperfection therein, or conditions that render it unsuitable for the reception of this work. Should plumbing contractor proceed without making such written report, he shall be held to have accepted such work and the existing conditions and he shall be responsible.

3.4 CERTIFICATES OF INSPECTION AND APPROVAL:

A. Upon completion of work, plumbing contractor shall furnish to the Owner certificates of inspection or approval from the authorities having jurisdiction if certificates of inspection or approval are required by law or regulation.

3.5 SLEEVES AND OPENINGS:

A. All sleeves and openings required shall be located and provided by the plumbing contractor for his portion of the work. Core drilling for missed sleeves shall be provided by the delinquent contractor.

B. In order to minimize liquid leakage or transfer of air between floors, it is the intent that pipe penetrations of floors (except in plumbing chases) be held to a minimum. Where it is necessary to penetrate floors, the pipe shall pass through sleeves set in the concrete, and the space between the pipe and sleeve shall be caulked to make it air tight.

3.6 ACCESS TO EQUIPMENT AND VALVES:

A. All control devices, specialties, valves and removable panels on equipment shall be so located as to provide easy access for inspection and maintenance, including removal of any interior components.

B. Should any work, such as piping, ducts, conduit, etc. be installed without due regard to the accessibility of devices installed by other contractors, the installation shall be relocated, offset or rerouted without cost to the Owner.

C. Where devices are to be concealed in walls or above nonremovable ceilings, the plumbing contractor shall furnish the required access panels to the GC for installation for their respective equipment.

D. Size of panels shall be 12" x 12" square for all wall panels and 24" x 24" for ceiling panels.

3.7 COORDINATION:

A. The plumbing contractor is cautioned that portions of the building have an unusually high quantity of piping, ducts, conduits, and other mechanical equipment, and space is limited. The contractor shall offset pipes as required to avoid interference at no additional cost to the Owner. Generally pipes in which grade must be maintained, such as waste and storm drain piping, and sprinkler piping, shall have first priority. Other pipes shall be offset as required to avoid those items. The HVAC contractor will be required to prepare coordinated shop drawings of the ductwork. The Plumbing Contractor will be furnished copies of these drawings and shall use them for his coordination drawing efforts and in determining pipe routing.

B. The HVAC contractor will make the basic duct drawings and send sepias to the plumbing contractor. Within 30 days after receiving the sepias and “CADD disk”, the plumbing contractor shall return them to the mechanical subcontractor, marked to show how plumbing pipes cross the ducts, and with suggested pipe elevation for each pipe. The HVAC contractor will use this information plus similar information received from other contractors to prepare the finished coordination drawings.

C. The HVAC contractor shall provide manufacturers installation drawings as shipped with equipment, field working and location drawings, coordination drawings, wiring diagrams as required to show information required for information and coordination of the work for other trades. This includes locations of equipment, sleeves, foundations, curbs, pipe connections, wiring connections, etc. These drawings shall be provided in advance of work in the area so that the necessary coordination can be done at the proper time. The drawings shall be submitted to the A/E for record only and other subcontractors involved in the work.

D. The HVAC contractor shall coordinate the work of his trade and other trades in order that interference between plumbing, mechanical, electrical, architectural and structural work will be avoided. Piping, ducts, conduits, etc. shall be kept as close as possible to ceiling, walls, columns, etc. in order to take up the minimum amount of space; and all offsets, fittings, etc. required shall be furnished without additional cost to the Owner. In case interferences develop, the Engineer will decide which equipment shall be relocated regardless of which was first installed.

E. Minor changes required by Owner, and any incidental changes required to meet structural conditions or to match trim etc. shall be made by this contractor without extra cost to the Owner. Generally, all pipes, and conduits except those in the equipment room and in other locations specifically designated on the plans shall be run concealed in furrings and chases. In the event that it is necessary to expose these items in finished areas, this shall be called to the Architect's attention before proceeding with the work.

F. The plumbing contractor shall cooperate closely with the General Contractor and all other contractors on the job in order that the job will progress smoothly to its completion. He shall lay out his pipe in advance of pouring floors, or installing walls, shall provide to the General Contractor the location and size of any openings he

may require, and shall furnish for the installation by the General Contractor any sleeves, forms, inserts, or hangers required for his work. In the event of failure to do these things at the proper time, or improper location of the required items, the cutting and patching required to rectify the errors shall be done by the plumbing contractor who installed the original material being cut but shall be paid by the contractor at fault, as determined by the Engineer, at no additional cost to the Owner.

G. All equipment shall be installed with sufficient access and clearance for maintenance, repairs, and replacement. In the event that it appears necessary to install equipment without proper access or clearance, the work shall be stopped until written permission is received from the Engineer to install the equipment. Pipes shall be installed in such a way as to allow maximum headroom where pipes are in occupied areas. Valves shall be located in such a position that they are easily accessible and so that the valve wheels can be easily turned to full open or full closed positions.

3.8 CHASES, CUTTING AND PATCHING:

A. In new construction, chases in walls for any work to be installed by the plumbing contractor will be provided by the general contractor provided full information as to the location and size of such chases and the necessary frames for openings is given to him by this contractor in such time as to cause no delay in the general contractor's work.

B. If this contractor should neglect to furnish the required information and by reason of his neglect chases and openings are not provided, the delinquent plumbing contractor shall, at his own expense, cut the required chases and openings and make such repairs as shall be necessary to restore the work to its original finish.

C. The cutting of chases, openings, or holes in floors and ceilings shall be done in a manner as not to endanger the stability of the structure or any part thereof. The Plumbing contractor's shall not in any case cut or alter the work of any other contractor without the approval and under the direction of the Architect or Engineer. All repairs resulting from cutting shall be under the supervision of the Superintendent of the General Contractor.

3.9 DISCREPANCIES:

A. In the event of discrepancy, immediately notify the architect for clarification and resolution.

B. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.10 JOB CONDITIONS:

A. Safety: Observe all required safety regulations and the manufacturer's warnings and instructions during the storage, handling and applications of materials.

B. Necessary precautions shall be taken to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion or other harm.

C. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at the end of each day's work, in accordance with all applicable federal, state, and local codes.

END OF SECTION 22 01 00

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. This section delineates the DIVISION OF WORK between Division 22 and Division 26.

B. Specific work to be done under Division 26 is hereinafter listed or described. All other work necessary for the operation of Division 22 equipment shall be performed under Division 22.

1.2 DIVISION OF WORK:

A. All individual motor starters for plumbing equipment (pumps, etc.) shall be furnished and installed under Division 22 unless indicated as a part of a motor control center or designated "motor control trough". Motor starters provided in motor control centers and at motor control troughs shall be furnished under Division 26.

B. Under Division 26, power wiring rough-in shall be provided from junction box, trough, starter or disconnect switch, as required by the specific piece of equipment. Equipment final connections shall be provided under Division 26.

C. All relays, actuators, timers, seven-day clocks, alternators, pressure, vacuum, float, flow, pneumatic-electric, and electric-pneumatic switches, aquastats, freezestats, line and low voltage thermostats, float switches, remote selector switches, remote push-button stations, emergency break-glass stations, interlocking wiring, disconnect switches required by Division 22 equipment, and other appurtenances associated with equipment under Division 22 shall be furnished, installed and wired under Division 22.

D. All wiring required for controls and instrumentation not indicated on the drawings shall be furnished and installed by Division 22.

E. Additional power wiring required for plumbing equipment over and above what is shown on electrical drawings shall be provided under Division 22 work.

END OF SECTION 22 01 04

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SECTION 22 02 06 - ROUGH-IN AND CONNECTIONS TO EQUIPMENT FURNISHED BY OTHERS

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Rough in for all items of equipment that require waste, vent or water connections, regardless of which contractor furnished the equipment.

B. Make final connections to those items for equipment furnished by others except where specifically designated on the drawings or in these specifications otherwise.

C. Generally, final connections to equipment shall be by the plumbing contractor.

D. Generally, final connections to water heaters, and other equipment of this type will be by the plumbing contractor.

1.2 ROUGH-IN DRAWINGS:

A. The plumbing contractor shall secure from each contractor furnishing items of equipment (requiring plumbing connections) roughing-in prints and complete detail shop drawings of all equipment, and review at the job each area with the respective contractor before roughing-in. Make all adjustments as required. In the event that the plumbing contractor fails to obtain the roughing-in prints for whatever reason, and roughs in the pipes at the wrong location, the pipes shall be relocated as required at the expense of the plumbing contractor. In the event that the plumbing contractor roughs in the pipes in accordance with prints furnished by the respective contractor, and it turns out that the pipes are in the wrong locations, any costs of relocating the roughed-in pipes will be paid by the contractor furnishing that item of equipment.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials shall be the same as are described in the specifications for the various piping systems.

END OF SECTION 22 02 06

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SECTION 22 02 08 - PLUMBING IDENTIFICATION AND PAINTING

PART 1 - GENERAL

1.1 SCOPE:

A. All exposed pipe, hangers, and equipment installed by this subcontractor shall be painted unless it has a factory finish or is noted otherwise. Exposed chromeplated brass, stainless steel, or plastic piping will not be painted.

B. Type of identification devices specified in this section include the following:

1. Plastic Pipe Markers
2. Plastic Tape
3. Valve Tags
4. Valve Schedule Frames
5. Engraved Plastic-Laminate Signs

1.2 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. ANSI Standards: Comply with ANSI A13.1 for lettering size, colors, and viewing angles of identification devices.

1.3 SUBMITTALS:

A. Product Data: Submit product specifications and installation instructions for each identification material and device required.

B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.

C. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags," in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 22.

PART 2 - PRODUCTS:

2.1 PLASTIC PIPE MARKERS:

A. Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, color-coded, plastic-sheet pipe markers, complying with ANSI A13.1.

B. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:

1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.

2. Adhesive lap joint in pipe marker overlap.
3. Laminated or bonded application of pipe marker to pipe (or insulation).
4. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".

C. Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:

1. Laminated or bonded application of pipe marker to pipe (or insulation).
2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2" wide; full circle at both ends of pipe marker, tape lapped 3".
3. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.

D. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.

E. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

2.2 PLASTIC TAPE:

A. Manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

B. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2-1/2" wide tape for larger pipes.

C. Color: Comply with ANSI A13.1, except where another color selection is indicated.

2.3 VALVE TAGS:

A. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener. Provide 1-1/2" diameter tags, except as otherwise indicated.

B. Valve Tag Fasteners: Manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

2.4 VALVE SCHEDULE FRAMES:

A. For each page of the valve schedule, provide a glazed display frame, with screws for removable mounting on walls. Provide frames of rigid plastic or metal, with plastic glazing.

2.5 ENGRAVED PLASTIC-LAMINATE SIGNS:

A. Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as

otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.

C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.6 LETTERING AND GRAPHICS:

A. Coordinate names, abbreviations and other designations used in mechanical identification work with corresponding designations shown pre-existing, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

B. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H).

2.7 PAINT:

A. All products shall be in accordance with the specifications for painting in the general contract.

PART 3 - EXECUTION:

3.1 GENERAL:

A. Any equipment shipped with a factory applied finish shall be touched up to repair any damage to the finish so that it is the same as new.

B. In the mechanical equipment rooms the plumbing contractor shall be responsible for painting all piping, equipment, and accessories installed under their respective contract.

C. In other parts of the buildings items which are in place in finished areas when general building painting is done will be painted by the General Contractor. Items installed after painting is completed shall be painted by the plumbing contractor, as directed by the architect.

D. All nongalvanized ferrous metal hangers and miscellaneous metal used in connection with the plumbing systems shall be painted with two coats of enamel.

E. All exposed piping including insulated piping, insulated by this contractor shall be painted two coats of lead and oil paint. Elastomeric pipe insulation shall have two coats of enamel of the type recommended by the insulation manufacturer.

F. Do not field paint exposed copper pipe, brass valves, or brass trim on iron body valves, or machinery or equipment that has a factory applied finish unless otherwise specified. Do not paint plastic pipe.

G. Painted pipes which are buried in earth, shall be allowed to dry before backfilling.

H. All paint shall be delivered to the project in unbroken containers. Containers shall be labeled to indicate color, directions for use, manufacture, and date of manufacturer. Directions for use of the paint shall be carefully followed in the mixing and general application. All paint shall be applied under dry and dust free conditions. Sufficient time shall elapse between paint coats to permit satisfactory recoating. Once started all painting shall be completed without delay.

3.2 PIPING SYSTEM IDENTIFICATION:

A. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums), exterior non-concealed locations and above removable acoustical ceilings.

1. Near each valve and control device.
2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
4. At access doors, manholes and similar access points which permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
7. On piping above removable acoustical ceilings.

3.3 PAINT SCHEDULE:

A. All exposed equipment, pipes, conduits, or other appurtenances shall be painted by this sub-contractor with materials and application as specified in the general contract specifications and as directed by the architect.

B. All concealed pipe covering shall be identified by colored bands and legends. The direction of flow shall be indicated by flow arrows.

C. All exposed pipe covering shall be totally painted the color of the band color listed below. All exposed pipe hangers, rods, supports, channels, etc. shall be painted flat black.

D. Color coding strips shall be painted no less than every 15 linear feet plus wherever entering or leaving a space and near valves. (Tape is acceptable). Width of strip shall be approximately 1/5 of the diameter of pipe plus covering if any, but in no case less than 1/2 inch. Color coding shall conform OSHA requirement.

E. Directions arrow and fluid name shall be applied by sticker at same spacing as above. The stickers shall be secured by color coded tape wrapped two times around the pipe at each end of the label or spring cords.

F. Standard colors and legends are as follows: (Plumbing)

1. PIPE IDENTIFICATION: Piping systems in mechanical rooms shall be completely painted with the applicable colors listed below and have appropriate self-sticking or strap-on identifications and arrows indicating direction of flow. Piping and ducts in chases above ceiling, etc. shall be color banded and have stencil markings at appropriate intervals. On straight

runs of piping, markings should be no further than 30 feet apart; and stencil identifications, color bands, and direction arrows shall be near each valve, pressure reducing valve, heat exchanger, etc. Where pipe passes through walls or floors, marking shall be near the penetration on both sides. Markings shall be at each directional change of all piping systems. Mechanical room pipe color and the color of bands are to be as follows:

Piping System	Sherwin Williams Color Number	Stencil Color	Identification
Water, Cold Domestic	SW 4085	Safety Green	DOM CW
Water, Hot Domestic	SW 4083	Safety Orange	DHW
Water, Hot Domestic Recirculating	SW 4083	Safety Orange	DHWR
Gas	SW 4032	Safety Black	Gas
Supports, Hangers	SW 4032	Vacuum Black	

G. Pipe identification should contrast in color to the pipe colors and be easily readable. The width of color bands should be equal to the size of the stencil indicated below.

H. For insulated pipe systems, stencil sizes should be as follows:

1. For pipes up to 1 inch, use 1 inch letters.
2. For pipes 1 inch to 2 inches, use 2 inch letters.
3. For pipes 2 inches to 6 inches, use 3 inch letters.
4. For pipes above 6 inches, use 4 inch letters.

I. For un-insulated systems, stencil sizes should be as follows:

1. For pipe diameters up to 1 inch, use 1/2 inch letters.
2. For pipe diameters from 1 inch to 2 inches, use 1 inch letters.
3. For pipe diameters from 2 inches to 6 inches, use 2 inch letters.

J. Valve handle shall be painted the same color as the stripes on the pipe.

3.4 VALVE IDENTIFICATION:

A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

B. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Architect/Engineer.

C. Provide a 1” blue dot on ceiling grid for isolation valves above ceiling.

3.5 PLUMBING EQUIPMENT IDENTIFICATION:

A. Install engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:

1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.

2. Pumps and similar motor-driven units.

B. Lettering Size: Minimum 3/8" high lettering for name of unit where viewing distance is less than 2'-0", 3/4" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 the size of principal lettering.

C. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, and warn of hazards and improper operations.

D. Operational valves and similar minor equipment items located in non-occupied spaces (including machine rooms) may, at installer's option, be identified by installation of plasticized tags in lieu of engraved plastic signs.

END OF SECTION 22 02 08

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Provide all concrete and masonry work as indicated on the plumbing contract drawings, unless it is indicated that it will be by the general contractor. This includes bases for equipment.

PART 2 - PRODUCTS

2.1 GENERAL

A. All cement, gravel, sand, reinforcing rod, brick, block and other materials comply with the requirements for those materials in the specifications for the general contract as part of Division 03.

PART 3 - EXECUTION

3.1 GENERAL

A. The workmanship and manner of placing the materials shall comply with the requirements for those items in the specifications for the general contract.

B. Bases shall have smooth tops and cambered edges.

END OF SECTION 22 02 10

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PART 1 - GENERAL:

1.1 SCOPE OF WORK:

A. Work Included: This section describes the requirements for excavating and backfilling pipe trenches. Obtain proper elevations from the Architect prior to the installation of underground piping, piping below slabs, and piping under foundations.

B. All excavation will be unclassified.

C. All underground sanitary and storm piping shall have bedding and backfill per the pipe manufacturer's written installation instructions.

1.2 QUALITY ASSURANCE:

A. Safety Codes and Standards: Perform trenching work, including shoring in compliance with the applicable requirements for governing authorities having jurisdiction.

B. Existing Utilities and Trees: Offset piping to avoid existing utilities and trees. Existing utility lines shall be protected from damage during excavation and backfilling, and if damaged, shall be repaired by the plumbing contractor, or at his expense. Where roots of live trees are uncovered in excavation, they shall be carefully protected during construction.

PART 2 - PRODUCTS:

2.1 MATERIALS FOR BEDDING AND BACKFILL:

A. Type 1: Clean grandular material - crushed limestone, 100% retained on 1/2" screen and 100% passing 3/4% screen. Use for subsoil foundation drainage line backfill.

B. Type 2: Crusher-run grandular material - 2" mains crusher-run crushed limestone with copious quantity of limestone dust; use for all fill and backfill except where clean granular material, earth material or sand is indicated or specified.

C. Type 3: Earth material - clay soil free of vegetable matter and foreign matter, from source approved by Architect/Engineer. Site materials free of organic and foreign materials will be acceptable. Use of fill and backfill in exterior planted areas from initial backfill to below 6" below grade.

D. Type 4: Topsoil - clean black topsoil from source approved by Architect/Engineer; use for 6" depth in planted area.

E. Type 5: Sand - clean river sand; use for initial bedding and for 4" around all underground piping.

PART 3 - EXECUTION:

3.1 EXCAVATION AND BACKFILL - GENERAL:

A. All excavation and backfill required for the installation of work shall be the complete responsibility of the plumbing contractor whose work requires excavation and backfill.

B. Plumbing contractor shall be responsible for the proper layout and the establishment of all lines and levels required for the execution of his work.

C. No excavation or backfill shall be done within drip line of trees not shown to be removed on architectural drawings. No trees shall be removed without prior approval of the Architect. Provide protection for trees within 15' of utility excavation.

D. When services are to be run side-by-side, a common trench may be used providing the required vertical and horizontal separation between the various services are maintained and methods of bedding and backfill meet the approval of the Architect/Engineer. Contractors involved shall make their own agreement as to the sharing of cost for the common trenching and backfill work.

E. Excavation and trenching shall be in accordance with the North Carolina Department of Labor.

3.2 TRENCHING:

A. Unless otherwise noted on plans, all trenching for underground work shall be open cut from the surface. The sides of the trench shall be shored if vertical, or otherwise if soil conditions required. The width of the trench shall be limited to that necessary for proper installation of the work. The distance between the trench wall and the sides of pipe below a level 1' above the top of the pipe or duct shall not exceed 12".

B. The width of trench 1' above top of pipe shall be only as wide as necessary for shoring, bracing and proper performance of the work.

C. The depth of trench shall not exceed that required to achieve depth of cover indicated, with overdig permitted only for bedding material.

D. If the width of trench exceeds that required, the space shall be filled with thoroughly compacted granular material or concrete.

3.3 SHORING AND PROTECTION:

A. Plumbing Contractor responsible for excavation work shall be required to provide all necessary barricades, fencing, sheet piling, warning signs, pumping, etc., for the protection of workers, general public and properties. Excavation work shall comply with ASA Standard A10.2 "Safety Code for Building Construction" and ACC Standard "Manual of Accident Prevention in Construction."

3.4 EXCESS EARTH FROM EXCAVATION:

A. All surplus earth shall be removed by the plumbing contractor from the building and disposed of at his own expense, where directed by the Architect.

B. Debris, trash or rock not usable for fill shall be removed from the site by the plumbing contractor.

C. Plumbing Contractor shall be responsible for immediate clean-up of streets, roadway and private property affected as a result of their work.

3.5 BACKFILL:

A. Backfill shall not begin until after plumbing contractor's work has been properly installed and inspected by the authority having jurisdiction and approved by the Architect/Engineer.

3.6 PLACEMENT:

A. In general, all initial backfill (to a point 6" above top of pipe) shall be of the same material as the bedding.

B. Upper fill (above initial fill) shall be as follows:

1. Within building - Type 3 material.
2. Exterior of building under paved areas - Type 2 material.
3. Exterior of building - Type 3 material. When beyond area of GC work, top with Type 4 material.

C. Before starting any backfill work, plumbing contractor shall obtain Architect/Engineer approval of granular materials to be used, method of placing same and type of compacting equipment to be used. Do not place any backfill material until bottoms of excavations have been thoroughly cleaned of all water, debris and loose or soft soils.

D. Placing of granular material shall be placed in lifts of 12" maximum. Compact each lift to 95% of maximum dry density as determined by the AASHA T-180 method of compaction.

E. Place earth material in 6" maximum thickness layers and compact to dry density of at least 90% of maximum dry density as measured by AASHO T-180.

3.7 RESTORATION OF EXISTING CONDITIONS:

A. When the excavation is within the area of finished site work by the General Contractor, backfill to the height of rough grade. Final surfacing shall be by the General Contractor.

B. When excavation is beyond the area of general construction work, final surface of the excavation and adjacent disturbed areas shall be restored to match the original condition by sodding, seeding asphalt paving, concrete, etc., as required. Work shall conform to applicable sections of the specifications.

C. When the excavation is on public property, restoration of surface conditions shall meet the requirements of public authorities having jurisdiction.

END OF SECTION 22 02 12

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PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. This work consists of furnishing all piping, labor, materials, accessories and equipment required to install the compressed air system as shown, specified, and/or reasonable implied, for a complete first-class system.

PART 2 - PRODUCTS

2.1 PIPE, FITTINGS AND JOINTS:

A. Pipe shall be hard drawn Type L copper tubing conforming to ASTM B-88. All pipe shall arrive to the site sealed and closed to be dust and oil free.

B. Fittings shall be wrought copper conforming to ASTM B-16.22-1963. All fittings shall arrive to the site sealed and closed to be dust and oil free.

2.2 PIPING ACCESSORIES:

A. Unions for joining similar metal shall be brass or bronze ground joint type. Unions for joining dissimilar metals shall be dielectric type as manufactured by Epco, Walter, Vallett, or Capitol Mfg. Co.

B. Air Line Pressure Regulator- Parker, or approved equal high capacity series regulator. Regulator shall be a R119 Series rated for 300 psig working pressure. Provide with standard 0-125 psi adjustment range, 0-160 psig pressure gauge, unit mounting bracket, and with regulator pipe size as indicated on the drawings.

C. Escutcheons shall be heavy spun of stamped chrome plated steel, split hinged.

D. Drip pockets shall be pipe nipples and reducers with Dixon Model 17-016-017 (1/2” size) or approved equal drain valves.

E. Valves shall be full glow bronze body double real ball type as manufactured by Conbraco-“Apollo” 77-100 Series, model numbers 77-103-1 (1/2” size) through 77-106-1 (1-1/4” size). Valve shall be rated for 600 PSI CWP, 150 PSI SWP pressure service.

2.3 AIR COMPRESSOR UNIT AND AIR DRYER: (AC-1 and AD-1)

A. The air compressor with air dryer shall be furnished by the PC, refer to plan schedules for type and plan layout quantity/locations. The plumbing contractor shall provide the final connection.

B. The air compressor (AC-1) shall be as manufactured by Quincy or approved equal. The air compressor shall be a two stage dual compressor type with a pressure rating of 175 PSIG. The unit shall have an automatic tank drain, oil sight glass, low oil level shutdown, and air-cooled

after cooler. The unit shall have a minimum 200 gallon ASME certified air tank and dual motor controls.

C. The air dryer shall be as manufactured by Quincy or approved equal. The air dryer shall be a floor mounted type with R-404a refrigerant. Dryer shall have an “on-off” switch, refrigerant suction pressure gauge, and drain test button.

PART 3 - EXECUTION

3.1 PIPE FITTINGS:

A. All fittings for copper tubing to be wrought copper brazing fittings.

3.2 PIPE JOINTS:

A. All joints to be brazed except those at valves or equipment requiring screw connections.

B. Use Sil-Phos silver solder and Handy flux.

C. Borax and alcohol mixtures, resin or petroleum base paste flux are not permitted.

D. Technique and joint preparation per manufacturer’s instructions.

E. Avoid excess flux inside joint.

3.3 SCREWED PIPE JOINTS:

A. Thread of pipes, fittings and couplings shall conform to requirements of ANSI B2.1.

B. Length of threading shall produce sufficient number of perfect threads to insure full metal to metal contact when screwed home.

C. Ends shall be countersunk, reamed and cleaned of chips and burrs, inside and out.

D. Connections shall be made up full with not more than one full thread exposed by such method as will obviate strains or twists in pipes and fittings.

E. Joints shall be made up with teflon tape applied to the male thread only. Care shall be taken not to allow tape or debris to work into inside of pipe.

F. Should leaking joints occur, when tests are made, such joints shall be dismantled, reinstalled and tested.

G. Place hangers at all changes of pipe direction and at valves and fittings as necessary for adequate support.

3.4 GENERAL PIPING INSTALLATION:

A. The contractor shall furnish and install complete system of piping as indicated on the drawings or as necessary to complete the working systems in accordance with the intent of the drawings and specifications.

B. Piping systems shall be in accordance with the applicable requirements of the ANSI Code for Pressure Piping, ANSI B31.1-1955, incl. addendum 1963 and NFPA 56F.

C. Piping system mains, branches and connections to outlets and equipment shall be valved as indicated or required to completely control the entire apparatus and/or appurtenances.

D. Pipe elevations may be adjusted as required or directed at the job site. Such changes or deviations do not relieve the sub-contractor from responsibility for the proper erection of systems of piping indicated and/or specified.

E. Piping shall be installed without spring or forcing and shall be properly supported. Adequate provisions shall be made for expansion, contraction, slope and anchorage. Allowable stress of any piping or fittings shall not be exceeded during installation system testing or under normal service conditions.

F. Piping shall be cut accurate for fabrication to measurement established at the job site.

G. Piping shall be installed without obstructing windows, doors, access panels or openings, or fixtures or equipment.

H. Burrs and cutting slag shall be removed from cut pipe ends by reaming.

I. Changes in direction shall be made with 45 degrees or degree ells, or tee fittings.

J. Reducing fittings shall be used where required. No bushing will be permitted.

K. Pipes shall be fitted with escutcheons at all exposed penetrations of walls, floors or ceilings. Escutcheons shall be of sufficient outside diameter to amply cover sleeved openings.

3.5 COMPRESSOR INSTALLATION:

A. The compressor shall be mounted on concrete base or pad as shown on the plans. The mounting frame shall be grouted with cement to the base to assure a firm, level mounting.

B. The compressor shall be connected to the piping system on the drawings.

3.6 AIR DRYER:

A. The air dryer shall be installed adjacent to the compressor either on concrete pad or secured firmly as shown on the drawings.

B. The dryer shall be connected into the compressed air system as shown.

3.7 TESTS AND INSPECTION:

A. Authorized representative of the equipment manufacturer shall supervise, inspect and test the complete installation and verify that all requirements have been complied with, and shall instruct the Owner's designated representative in the operation and maintenance of the system.

3.8 TESTING:

A. Blow lines clear after erection but before installation of outlet valves.

B. Use water pumped (oil-free) nitrogen or air.

C. Test each section at 150 psig during installation and before outlets connected, using soap suds test. Repair leaks and retest.

D. When system is completely installed, make a final 24 hour standing pressure test.

END OF SECTION 22 03 18

PART 1 - GENERAL

1.1 SCOPE OF DIVISION 22 WORK:

A. This work shall consist of furnishing all labor, material, equipment and services necessary for the installation of all equipment specified hereinafter.

B. Systems, piping and components principally relevant to this section include:

1. Soil and Waste Piping
2. Vent Piping
3. Storm Water Piping
4. Domestic Water and Forced Main Piping
5. Other items where shown on the drawings or as specified.

PART 2 - PRODUCTS

2.1 SANITARY WASTE PIPING:

A. All cast iron piping and fittings shall meet the latest standards and specifications of the Cast Iron Soil Pipe Institute (CISPI) and of the American Society for Testing and Materials (ASTM).

B. All interior soil and waste piping below grade and to a point five (5) feet outside the building shall be Schedule 40 PVC.

C. All interior soil and waste piping 2" and larger above grade shall be non-hub or hub & spigot service weight cast iron pipe. Fittings shall be service weight cast iron.

D. All interior soil and waste piping 1½" and smaller, above grade shall be galvanized wrought iron with galvanized cast-iron drainage fittings or copper DWV piping and drainage fittings.

E. Long turn drainage fittings shall be used in all cases except where space limitations make their use impractical.

2.2 VENT PIPING:

A. Vent pipe 1-1/2" above grade shall be of Schedule 40 galvanized steel, with galvanized malleable iron screw fittings. Vent piping 2 inches and larger shall be service weight cast iron soil pipe with service weight cast iron fittings.

B. Vent piping below grade shall be Schedule 40 PVC. Minimum vent pipe size below grade shall be two (2) inches in diameter.

2.3 STORM WATER PIPING:

A. All interior storm piping below grade to a point approximately five (5) feet outside the building shall be Schedule 40 PVC.

B. All interior storm piping above grade shall be non-hub or hub and spigot service weight cast iron pipe with service weight cast iron fittings or galvanized steel with galvanized malleable iron screw fittings.

C. All cast iron piping and fittings shall meet the latest standards and specifications of the Cast Iron Soil Pipe Institute (CISIP) and of the American Society for Testing and Materials (ASTM).

2.4 DOMESTIC WATER AND FORCED MAIN PIPING:

A. Pipe material for above ground installation shall be type "L" hard drawn copper tubing with 125 psi solder joint wrought copper fittings.

B. Underground service outside the building shall be ductile iron with 250# joints and fittings or type "K" hard drawn copper tubing.

C. Pipe material for below ground installation, inside the building shall be Type "K" soft temper copper tubing without fittings or joints.

D. Solder for joints 1½" and larger shall be silver soldered joints. Smaller than 1½" shall be soldered with 95-5.

E. Fittings for copper pipe shall be wrought copper.

F. All exposed piping in finished room (including cabinets) used in connection with plumbing fixtures shall be chromium plated brass pipe with plated cast brass fittings.

2.5 COMPOUNDS, SOLDER AND LEAD:

A. Pipe Thread Compound:

1. Crane, Dixon, Rutland, or equal, or Teflon tape type.

B. Lead-free solder-joint solder: 95% tin and 5% antimony. Joints on larger pipe shall be made with a high-temperature brazing solder, Sil-phos or equal, except use 95-5 at valves.

C. Asphaltic Joint Compound:

1. G-K Jointite, Korite or equal.

PART 3 - EXECUTION

3.1 GENERAL:

A. For purposes of clarity and legibility, the contract documents are essentially diagrammatic and, although size and location of piping are drawn to scale wherever possible, plumbing contractor shall make use of all data in all of the contract documents and shall verify this information at building site.

B. The contract documents indicate required size and points of termination of pipes and suggest proper routes of piping to conform to structure, avoid obstructions and preserve clearances. However, it is not intended that the contract documents indicate all necessary offsets, and it shall be the work of this section to install piping

in such a manner as to conform to structure, avoid obstructions, preserve headroom and keep openings and passageways clear, without further instructions or cost to the Owner. The contractor shall fully inform himself regarding any and all peculiarities and limitations of the spaces available for the installation of all work and materials furnished and installed under the contract. He shall exercise due and particular caution to determine that all parts of his work are made quickly and easily accessible. Although the locations of the equipment and piping may be shown on the contract documents in certain positions, the contractor shall be guided by the architectural details and conditions existing at the job, correlating this work with that of others. Provide all offsets as required to produce a neat, workmanlike arrangement.

C. The plumbing contractor shall study all drawings and specifications to determine any conflict with ordinances and statutes. Likewise, any errors or omissions shall be reported prior to bidding. Any changes shall be shown in drawings made by this contractor, and any additional work shall be performed at no additional cost to the Owner.

D. Submittal of bid shall indicate the contractor has examined the site and contract documents and has included all required allowances in his bid. No allowance shall be made for any error resulting from contractor's failure to visit job sites and to review contract documents and bid shall include costs for all required drawings and changes as outlined above, all at no additional cost to the Owner.

E. All piping shall be installed to prevent unusual noise from the flow of water under normal conditions. Insert one (1) inch strip of hair felt to isolate all piping from any direct contact with any part of the building, framing, conduit, etc.

F. Springing, bending or forcing of pipe will not be allowed. Use fittings for all offsets or changes in alignment of piping. Center hubs so cast iron or clay pipe will lay straight without pinched joints.

G. All changes in directions shall be made with approved fittings. Mitering, saddling or welding of smaller pipe and larger piping is prohibited.

H. Pipe openings shall be closed with caps or plugs during installation. Rags and tin cans are not considered suitable closures.

I. Damage by leaks - The plumbing contractor shall be responsible for damage to the grounds, walks, road, buildings, pipe systems, electrical systems and their equipment and contents, caused by leaks in the piping system being installed or having been installed herein. He shall repair at his expense all damage so caused. All repair work shall be performed as directed by the Architect.

J. The use of chemicals or so-called "Stop-Leak" compounds will not be permitted at any time.

K. Unions shall be provided at connection to all equipment.

L. Escutcheon plates shall be provided at all exposed penetrations of walls, ceilings, floors, etc.

M. All items of equipment and plumbing fixtures shall be provided with approved vacuum breakers to prevent backflow, as required by State Health Department and

local authorities having jurisdiction. All waste connections shall be installed with approved airbreak fittings to comply with the above requirements. Vacuum breakers where shown on Drawings or required shall be angle pattern with built-in lift type check valves as manufactured by Bidoro Manufacturing Company or approved equal.

N. Bypass Piping: Except as otherwise indicated, fabricate and install bypass piping using same materials and in same plane as connected piping, but one pipe size smaller. Include valve in bypass piping. Install bypass piping around control valves, PRV stations and as shown on drawings.

O. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain hot/chilled water piping system.

3.2 PIPE JOINING METHODS:

A. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.

B. Braze copper tube-and-fitting joints where indicated, in accordance with ANSI B31.1. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

C. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.

D. Hubless Cast-Iron Joints: Comply with CISPI 310.

E. Grooved Pipe Joints: Comply with fitting manufacturer's instructions for making grooves in pipe ends. Remove burrs and ream pipe ends. Assembly joints in accordance with manufacturer's instructions.

F. Install gray and ductile cast-iron water mains and appurtenances in accordance with ANSI/AWWA C600.

3.3 SANITARY WASTE PIPING:

A. Coat all piping with tar pitch or similar bituminous material, if not applied in factory.

B. Joints above grade shall be no-hub coupling consisting of an approved (ASTM A-48 & ASTM C-564) elastomeric sealing sleeve and stainless steel clamp, clamping screws and housing. Piping shall be supported at one side of joint at all joints made with coupling. MG coupling, Husky or Clamp-all will be acceptable.

C. All joints for below grade shall be bell and spigot piping shall be made with factory molded flexible compression couplings, factory formed, integral with the bell and

spigot of the pipe. Piping joints at the joining of partial sections of pipe not equipped with compressions couplings shall be made with firmly packed hemp, oakum, jute and Carey Sewertite or approved equal compound. Joints shall meet all applicable codes.

D. Minimum size of soil or waste piping below grade shall be (2) inches in diameter.

E. Install horizontal soil and waste piping to a uniform grade of not less than ¼ inch per foot for 2½ inch diameter and smaller, and not less than 1/8 inch per foot for diameters of 3 inches or larger.

F. Piping shall be supported at one side of joint and all joints made with no-hub couplings.

G. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Clear interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

H. Cleanouts: Install in sanitary above ground piping and sanitary building drain piping as indicated, as required by the International Building Code; at each change in direction of piping greater than 45°, at minimum intervals of 50' for piping 3" and smaller and 100' for larger piping; and at base of each vertical waste or waste stack. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building finish.

I. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membrane.

J. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions. Coordinate installation with roofing contractor.

K. All sanitary and storm piping below grade shall have a sandbedding per manufacturer’s installation instructions.

3.4 VENT PIPING:

A. Plumbing Contractor shall provide a complete venting system for the sanitary system as shown on the contract documents, and as described herein.

B. The vent system shall not be used for purposes other than venting of the plumbing system.

C. Piping shall be supported at one side of joints and all joints.

D. Minimum diameter of an individual vent above grade shall be at least one half-(1/2) the diameter of the drain served, except that no vent pipe shall be less than one and one quarter (1-1/4) inches in diameter.

E. All vent and branch vent pipes shall be sloped a minimum of one eight (1/8) inch per foot and so connected as to drain back to the soil or waste pipe by gravity.

F. Extension of vent pipes through a roof shall be terminated at least twelve (12) inches above the roof.

G. Minimum size vent through the roof shall be three (3) inches in diameter. When it is found necessary to increase the size of the vent extension to meet this requirement, the change in diameter shall be made inside the building at least one foot below the roof with an approved fitting.

H. The vents must be through the roofs before the final roofing is applied. Where necessary, the vents shall be offset in the roof construction so that they come through the roof at least 18" from walls and other objects projecting above roof surface.

3.5 STORM PIPING:

A. The storm system shall not be used for any purpose other than the removal of rainwater from the roof, sidewalks and paved areas. Storm water shall not drain into the sanitary sewer system.

B. Coat all piping below grade with tar pitch or similar bituminous material, if not applied in factory.

C. All joints below grade shall be made of approved elastomeric compression gaskets.

D. All joints above grade shall be non-hub coupling type consisting of an approved elastomeric sealing sleeve and stainless steel clamp, clamping screens and housing. Piping shall be supported at both sides of joint at all joints made with this coupling.

E. Pitch all horizontal storm water piping above grade a minimum of 1/8" per foot. All horizontal piping below grade shall be pitched to meet invert elevations shown on the contract documents.

F. Roof drains shall be furnished by the plumbing contractor and installed by the General contractor on the roof. The plumbing contractor shall make connections to drains.

G. Lay storm building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Clear interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

H. Cleanouts: Install in conductor piping and storm building drain piping as indicated, as required by the International Building Code; at each change in direction of piping greater than 45°; at minimum intervals of 50' for piping 3" and smaller and 100' for larger piping; and at base of each conductor. Install floor and wall cleanout covers for concealed piping. Select type to match adjacent building finish.

I. Flashing Flanges: Install flashing flange and clamping device with each cleanout passing through waterproof membrane.

3.6 DOMESTIC WATER PIPING:

A. Potable water piping shall include all domestic cold, hot and circulating piping.

B. The water service to the building shall maintain a minimum depth of three feet below the finished grade.

C. All copper piping shall have sweat joints, except at valves where sweat to threaded adapters shall be used. All pipes shall be reamed to full diameter before jointing. Ends of pipe and inside of fittings shall be cleaned and flux applied to entire area of pipe end to be soldered. On pipe 1-1/2 inches and larger, flux shall be applied to pipe and fittings. Solder shall be of the composition indicated below.

1. 1-1/2" and larger - Silver Solder
2. 1-1/4" and lower - 95-5 Solder

D. All water piping shall be pitched approximately one (1) inch per sixty (60) feet upward from source to facilitate drainage. Where water piping must change elevation to avoid structural or other obstructions, drain valves and air vents shall be provided.

E. Provide three quarter (3/4) inch hose end valve at all low points in system for drainage.

F. Dielectric unions or insulated couplings shall be installed between copper or brass piping material and steel piping material. Unions or insulated couplings shall be used for pipe sizes 2" and smaller, and dielectrically gasketed flanges and sleeves for pipes 2½" and larger.

G. Provide unions on inlet and outlet of all apparatus and equipment having connections 2" and smaller. Where valves are adjacent to equipment, union shall be on the downstream side of valves. For piping over 2" flanged points shall be used.

H. Chlorination of Water System:

1. After water system is completed, the entire system shall be chlorinated by injecting a strong solution of chlorine into the system of not less than 50 ppm. Valves shall be opened and closed to gain complete coverage of system. Let system stand for twenty-four (24) hours, then flush system to leave a minimum permissible concentration as recommended by the Health Department having jurisdiction. After flushing, satisfactory bacteriological results must be obtained or the mains must be re-chlorinated until satisfactory results are obtained.

END OF SECTION 22 05 10

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PART 1: GENERAL

1.1 SCOPE OF WORK:

A. This work shall consist of furnishing all labor, material, equipment, and services necessary for the installation of all equipment specified hereinafter.

B. Equipment and components principally relevant to this section include:

1. Sleeves, Seals and Escutcheons
2. Drip Pans
3. Pipe Hangers, and Supports
4. Other items where shown on the drawings or as specified.

PART 2 - PRODUCTS

2.1 SLEEVES, SEALS AND ESCUTCHEONS:

A. Provide sleeves for each pipe passing through walls, partitions, floors and roofs.

B. Sleeve Material:

	Type-	Designation
1.	1	Schedule 40 galvanized steel pipe.
2.	2	Duro coated cast iron body pipe with flashing clamp device integral to the pipe sleeve, similar to J.R. Smith 1720 or equal.
3.	3	Ductile iron pipe sleeve with center flange, flange end and plain end, length and size of the sleeve to be determined by the plumbing sub-contractor, manufacturered by Clow or equal
4.	4	Duro coated cast iron body pipe with flashing clamp device integral to the pipe sleeve, similar to J.R. Smith 1720 or equal.

C. Sleeve Sizes:

1. Sleeves for uninsulated pipe provide a minimum of ½" clearance between inside of sleeve and outside of pipe.
2. Sleeves for insulated piping shall be adequate size to accommodate the full thickness of pipe covering with a minimum ½" clearance for packing and caulking.

D. Sleeve Lengths:

	Location:	Sleeve Length
1.	Floors:	Equal to depth of floor construction including finish. In waterproof floor construction sleeves to extend minimum of 2" above finished floor level.

2. Walls and Partitions: Equal to thickness of construction and terminated with surfaces

E. Sleeve and Caulking and Packing:

Type / Designation	Caulking and Packing Requirements
A	Space between pipe and sleeve packed with oakum or hemp and caulked watertight with lead.
B	Space between pipe or pipe covering and sleeve shall be caulked with a fire resistant foam sealant.

F. Sleeve Application:

Sleeve Type	Location	Sleeve Caulking & Packing Type Designation
2	Interior walls, partitions and floors	B
2	Membrane, waterproof floor, roof and wall construction	B (Note: Another trade will install membrane up around sleeve and inside sleeve.)
3 or 4	Exterior walls	A
5	No membrane, waterproof, roof and wall construction where flashing is required	A or B

G. Escutcheons:

1. Provide escutcheons on all exposed piping passing through walls, floors, partitions and ceilings.
2. Escutcheons shall be held in place by internal spring tension or set screws.
3. Application:

Location:	Escutcheon Material
4. Finished spaces:	Anodized aluminum chrome-plated brass
5. Unfinished spaces excluding mechanical equipment rooms	Plain brass, cast iron or aluminum

H. Mechanical Sleeve Seals:

1. Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering mechanical sleeve seals which may be incorporated in the work include, but are not limited to, the following:

   a. Thunderline Corp.

2.2 DRIP PANS:

A. Examine the Drawings and, in cooperation with the Electrical Trade, confirm the final location of all electrical equipment to be installed in the vicinity of piping. Plan and arrange all overhead piping no closer than two feet from a horizontal and vertical line to electric motor controllers, switchboards, panelboards or similar equipment.

B. Where the installation of piping does not comply with the requirements of preceding paragraph, and where feasible, the piping shall be relocated of not practical as determined by the engineer. The plumbing contractor shall provide gutters as follows:

C. Provide and erect a gutter of 18 gauge galvanized steel under every pipe which is within 2'- 0" of being vertically over any motor, controllers, switchboards or the like.

D. Each gutter shall be soldered and made watertight, properly suspended and carefully pitched to a convenient point for draining.

E. In lieu of such separate gutters, a continuous protecting sheet of similar construction, adequately supported and braced, properly rimmed, pitched and drained, may be provided extending 2'-0" in all directions beyond the electrical item, over which such piping has to run.

F. Plumbing Contractor shall provide 3/4" drain to nearest floor drain or slop sink as approved.

2.3 PIPE HANGERS, SUPPORTS AND ANCHORS:

A. All bracket, clamp and rod sizes indicated in this Specification are minimum sizes only. The installing trade shall be responsible for structural integrity of all supports. All structural hanging materials except variable spring units shall have a safety factory of 5 built in.

B. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS Standards.

C. For copper tubing, supports shall follow schedule and specifications. Supports for uncovered lines shall be especially designed for copper tubing, shall be of exact outside diameter of tubing and shall be copper plated.

D. All hangers on piping including clevis hangers, inserts, clamps, stanchions, brackets, and rods shall be galvanized.

E. Pipe supports shall be of the following type and figure number as manufactured by F&S or Grinnell and as hereinafter indicated.

Pipe Hanger Schedule	F&S	Grinnell
360 degree shield split	981	-
Multi-J hood plate	9293	-
Clevis hanger	86	260
120 degree shield	980	167
Pipe saddle	900 Series	160
U-bolt	37	137

Pipe Hanger Schedule	F&S	Grinnell
Adjustable steel pipe stanchion	421	259
Welded steel bracket	800 or 801	195 or 199
Single bolt riser clamp	91 or 93	261
Double bolt riser clamp	92	Standard 40
Double bolt pipe clamp	89	295
Welded beam attachment W/B & N	966A	66
Insert	180-A, 180-B	280

F. Double bolt riser clamps shall be F&S, F&M or Grinnell and shall be subject to approval.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.

B. Prior to installation of hangers, supports, anchors and associated work, the plumbing contractor shall meet at project site with general contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified. This meeting shall be arranged by the plumbing contractor.

3.2 INSTALLATION OF BUILDING ATTACHMENTS:

A. Install building attachments at required locations, within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

3.3 INSTALLATION OF HANGERS AND SUPPORTS:

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping, ductwork or other supported mechanical or electrical items.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

C. Support fire protection piping independently of other piping.

D. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

E. Provisions for Movement: Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

F. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded.

H. Insulated Piping: Comply with the following installation requirements.

I. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.

J. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields. For pipe 8" and over, install wood insulation saddles.

3.4 INSTALLATION OF DRIP PANS:

A. Each gutter shall be soldered and made watertight, properly suspended and carefully pitched to a convenient point for draining.

B. In lieu of such separate gutters, a continuous protecting sheet of similar construction, adequately supported and braced, properly rimmed, pitched and drained, may be provided and extending 2'-0" in all directions beyond the electrical item, over which such piping has to run.

3.5 INSTALLATION OF PIPE HANGERS AND SUPPORTS:

A. Supports, hangers, and guides shall be provided for all horizontal and vertical piping in accordance with International Building Code and NFPA.

B. All pipe supports shall be of type and arrangement as hereinafter specified. They shall be so arranged as to prevent excessive deflection and avoid excessive bending stresses.

C. Provide all steel and concrete required for support and anchoring of pipes other than shown on Structural or Architectural Drawings.

D. Structural Engineer must approve method of hanging before work is started. Plumbing Contractor shall bear all responsibility for materials and workmanship as described in this section and shall make sure that all hangers and supports are properly and permanently connected to building structure.

E. All pipe supports shall be designed to avoid interference with other piping, hangers, electrical conduits and supports, building structures and equipment.

F. Spacing of pipe hangers shall comply with the following schedule:

Spacing of Hangers

Size of Pipe	Copper	Steel	Cast Iron
½"	6	8	-
¾" to 1"	8	8	-
1 ¼" to 3"	10	10	5
3 ½" & Over	10	10	5

3.6 INSTALLATION OF MECHANICAL SLEEVE SEALS:

A. Mechanical Sleeve Seals: Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form watertight seal.

3.7 ADJUSTMENT OF HANGERS AND SUPPORTS:

A. Adjust hangers and supports and place grout as required under supports to bring piping to proper levels and elevations.

3.8 EQUIPMENT BASES:

A. Concrete bases shall be provided by the plumbing contractor. Prepare scaled layouts of all required bases with dimensions of bases, and location to column center lines. Furnish templates, anchor bolts, and accessories, necessary for base construction.

B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings.

END OF SECTION 22 05 12

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. This work shall consist of furnishing all labor, material, equipment, and services necessary for the installation of all equipment specified hereinafter.

B. Equipment and components principally relevant to this section include:

1. Gate Valves
2. Check Valves
3. Globe Valves
4. Balancing Cocks
5. Ball Valves
6. Butterfly Valves
7. Circuit Setters
8. Other items where shown on the drawings or as specified.

PART 2 - PRODUCTS

2.1 VALVES - GENERAL:

A. Furnish and install valves shown on the drawings, specified herein and/or necessary for the control and easy maintenance of all piping and equipment. All valves shall be first quality of approved manufacture, shall have proper clearances, and shall be tight at the specified test pressure. Each valve shall have the maker's name or brand, the figure or list number and the guaranteed working pressure cast on the body and cast or stamped on the bonnet, or shall be provided with other means of easy identification. All valves shall be the product of one manufacturer except for special applications. Valves shall be Apollo, Nibco, Hammond, or Fairbanks. Where figure numbers of one manufacturer are stated, equivalent figure numbers can be substituted.

B. Valves shall be of minimum working pressure and materials as fittings specified for the service except as herein modified. All gate and globe valves shall be suitable for repacking under pressure. Regardless of service, valves shall not be designed for less than 125 pounds per square inch steam working pressure.

C. All throttling valves shall have a means of indicating valve position.

2.2 BRONZE GATE VALVES:

A. Screwed Ends, Union Bonnets, Solid Wedge:

1. Bronze Gates 125 # WSP
   a. Hammond IB631
   b. Nibco T-135
   c. Fairbanks U-0253

B. Solder Ends, Screwed Bonnets:

1. Bronze Gates 125# WSP
   a. Hammond IB648

b. Nibco S-134
c. Fairbanks 0282

C. Flanged Ends:

1. Iron Gates 125# WSP
   a. Hammond IR1140
   b. Nibco F-617-0
   c. Fairbanks 0405

2.3 CHECK VALVES:

A. Screwed ends, Union Bonnets:

1. Bronze Checks 125# WSP
   a. Hammond IB944
   b. Nibco T-433-B
   c. Fairbanks 0600

B. Solder Ends, Screwed Bonnets:

1. Bronze Checks 125# WSP
   a. Hammond IB-945
   b. Nibco S-433-B
   c. Fairbanks 0680

C. Flanged Ends

1. Iron Checks 125# WSP
   a. Hammond IR 1124
   b. Nibco F-918-B
   c. Fairbanks 0702

D. Swing check valves used as vacuum breakers: 15 degrees swing check, composition disc, 150 WSP: Nibco Fig T-433-Y or equal. Valves shall be 3/8" size.

2.4 GLOBE VALVES:

A. Screwed ends, union bonnets (composition or Teflon discs)

1. Bronze Globes 150# WSP
   a. Hammond IB413T (2-1/2" IB420)
   b. Nibco T-235-Y
   c. Fairbanks U-01

B. Solder ends, screwed bonnets (Teflon discs)

1. Bronze Globes 150#
   a. Hammond 1B423
   b. Nibco S-235-&
   c. Fairbanks

2. Iron Globes 125# WSP
   a. Hammond IR 116

b. Nibco F-718-B
c. Fairbanks 0131

C. Circuit Setters:
1. Circuit setters shall include brass balancing cock and taps for taking differential pressure readings. They shall be as manufactured by B&G, Taco, or Thrush.

2.5 BALL VALVES (2" AND BELOW)

A. Nibco T-595W
B. Jenkins 1100T
C. Crane or approved equal

2.6 BUTTERFLY VALVES:

A. Butterfly valves shall have aluminum bronze floating type disc; Buna-N hardback type seat for temperatures up to 170 deg., EPT seat for temperatures over 170 deg., stainless steel dry journal type stems. Bodies shall be wafer or lug type with extended necks adequate for 2" insulation above companion flanges. Operators shall be on-off or infinite throttling lever type in sizes 2" and 6", and gear operators for 8" and above.

B. The valves shall close drop-tight from 28" vac to 150 psi pressure differential.

C. They shall be Demco, Trane, Monarch, Dover, or approved equal. Butterfly valves shall not be used in steam piping systems.

PART 3 - EXECUTION

3.1 GENERAL

A. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.

B. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward for horizontal plane unless unavoidable. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.

C. Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive installation.

D. Applications Subject to Shock: Install valves with bodies of metal other than cast iron where thermal or mechanical shock is indicated or can be expected to occur.

E. Applications Subject to Corrosion: Do not install bronze valves and valve components in direct contact with steel, unless bronze and steel are separated by dielectric insulator. Install bronze valves in steam and condensate service and in other services where corrosion is indicated or can be expected to occur.

F. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends or types of pipe/tube connections.

G. Tube Size 2" and Smaller: Soldered-joint valves.

H. Pipe Size 2" and Smaller: One of the following, at Installer's option:
1. Threaded valves
2. Grooved-end valves
3. Butt-welding valves
4. Socket-welding valves
5. Flanged valves
6. Flangeless valves
7. Single flanges valves

I. Pipe size 2-1/2" and larger: One of the following, at installer's option:
1. Grooved-end valves
2. Butt-welding valves
3. Socket-welding valves
4. Flanged valves
5. Wafer valves
6. Single flange valves
7. Hub-and-spigot valves
8. Mechanical joint end valves

J. Valve System: Select and install valves with outside screw and yoke stems, except provide inside screw non-rising stem valves where headroom prevents full opening of OS&Y valves.

K. Non-Metallic Disc: Limit selection and installation of valves with non-metallic discs to locations indicated and where foreign material in piping system can be expected to prevent tight shutoff of metal seated valves.

L. Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.

M. Fluid Control: Except as otherwise indicated, install gate, ball, globe, and butterfly valves to comply with ANSI B31.1. Where throttling is indicated or recognized as principal reason for valve, install globe or butterfly valves.

N. Ball valves may be used in lieu of gate valves for equipment shut-off in size 2" and under.

O. Valves in positions where unauthorized closing could endanger safety or cause freezeups shall have wrench operation or lock shields and shall be marked with warning signs.

P. Gate valves, globe valves, and strainers shall be a minimum of the pipe size marked on the drawings. Reductions where necessary because of equipment or automatic valve size shall be made with the proper eccentric reducing fittings immediately adjacent to the inlet and outlet of the automatic valve. Bypasses for automatic valves shall be full size of the valve. Provide a service valve on either side of each piece of equipment.

END OF SECTION 22 05 23

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. This work shall consist of providing all labor, material, equipment, and services necessary for the installation of all equipment specified hereinafter. In addition to any other items called for in other sections of this specification.

B. Plumbing utilities, piping and equipment shall include the following items to the extent required on plans or in other sections of these specifications:

1. Water piping - domestic
2. Waste and vent piping
3. Storm piping
4. Gas piping
5. Water heater
6. Domestic water booster pump

C. Submit as part of Division 22 work proposed method and details to support and restrain plumbing equipment and materials listed here against seismic disturbances. This information shall be prepared by a seismic design engineer registered in the same state as the project site. The equipment and materials requiring this service shall be as required by IBC 2003 Chapters 16 and 17.

D. The submittal shall be prepared certified by an outfit with proven seismic engineering experience in this type of service. Submit qualifications of proposed outfit to A/E as part of materials list submittal. An organization with recognized proven experience are VMC-Southeast, Inc., 19901-E Henderson Rd. Cornelius, NC, Contact: John Crowley @ 704-896-3255 or fax @ 704-896-3256 and Seismic Control & Isolation, Inc., 11160 Downs Road, Pineville, NC 28134, Contact: Will Meckstroth, Phone: 704-504-8780, Fax: 704-504-9573. Other companies are equally acceptable upon submission of evidence of proven experience.

E. Provide quality assurance services, as applicable and as required under Section 1705 of IBC 2003 for equipment and systems specified under this contract. These services shall be provided by a professional engineer registered in the state where the project is located and working for the contractor at the contractor’s expense.

F. Provide special inspection of the anchorage of the electrical equipment specified here, as applicable, in accordance with requirements of Section 1707 of IBC 2003. The inspections shall be accomplished at contractor’s expense by qualified person that shall demonstrate competence to the satisfaction of the Building Inspector Official and the Engineer.

G. In addition to the above, provide, as applicable, component and component mounting by the manufacturer of the equipment specified here for components having an important factor of 1.0 or 1.5 in accordance with Chapter 16 and paragraph 1707.7.2 of IBC 2003.

1.2 APPLICABLE PUBLICATIONS:

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.

1. Federal Specifications (Fed. Spec.)
   a. RR-W-401C - Wire rope and strand

2. American National Standard Institute, Inc., (ANSI) Standards
   a. B18.2.1-1981 - Square and hex bolts and screws, inch series
   b. B18.2.2-1987 - Square and hex nuts (inch series)

3. American Society for Testing and Materials (ASTM) Publications.
   a. A307-86a - Carbon steel bolts and studs, 60,000 psi tensile strength
   b. A576-87a - Steel bars, carbon, hot-wrought, special quality
   c. A325-86a - High strength bolts for structural steel joints
   d. A36-87 - Structural steel
   e. A501-84- Hot formed welded and seamless carbon steel structural tubing

4. Manufacturers Standardization Society of the Valves and Fittings Industry (MSS) Publications:
   a. SP-58 - Pipe Hangers and Supports - Materials Design and Manufacture (1975)
   b. SP-69 - Pipe Hangers and Supports - Selection and Application (1976)

5. Underwriters Laboratories, Inc., (UL) Standards

6. Building Materials Directory (January 1981 with Quarterly Supplements)

B. Pipes that do not require special seismic restraints: seismic restraints may be omitted from the following installations:

1. Piping in mechanical equipment spaces less than 1-1/4" inside diameter.
2. All other piping less than 2-1/2" inside diameter.
3. All piping suspended by individual hangers 12" or less in length from the top of pipe to the bottom of the support for the hanger.

C. Shop drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed below shall be submitted. Submittals shall be complete in detail; shall indicate thickness type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.

1. Sway braces
2. Flexible couplings or joints
3. Resilient type vibration devices

D. Materials and Equipment: Materials and equipment shall conform to the respective specifications and other requirements specified below.

1. Bolts and Nuts

2. Squarehead bolts and heavy hexagon nuts, ANSI B18.2 and ASTM A307 or A 576
3. Bolts, underground, ASTM A325

E. Sway Brace: Material used for members listed in Tables I through II of this specification, except for pipes, shall be structural steel conforming with ASTM A36. Steel pipes shall conform to ASTM A501.

F. Flexible Couplings: Flexible couplings shall have same pressure ratings as adjoining pipe.

G. Flexible ball joints conforming to the following requirements may be employed on aboveground pipe. Joints shall have cast or wrought steel casing and ball parts capable of 360-degree rotation plus not less than 15-degree angular movement. Joints shall be certified to be suitable for the service intended by the manufacturer, based on not less than 2 years satisfactory operation in a similar application.

H. Guy wires shall conform to Fed. Spec. RR-W-410, as follows:

1.	5/32" diameter	Type V, Class 1
2.	3/16" to 5/16" diameter	Type V, Class 2
3.	1/4" to 5/16" diameter	Type I, Class 2

I. Sway Braces: Sway braces shall be installed on piping not otherwise rigidly anchored to preclude damage during seismic activity as follows:

1. All piping in mechanical equipment rooms 1-1/4" and larger.
2. All other piping 2-1/2" and larger.
3. Pipes and conduits suspended by individual hangers 12" or less in length from the top of pipe, conduit, or duct to the bottom of the structural support for the hanger, do not require sway braces.
4. Bracing shall generally conform to the details shown on the construction documents or to an approved alternate which can be demonstrated to be its equivalent. Provisions of this paragraph apply to all piping within a 5' line around outside of building unless buried in the ground. Piping grouped for support on trapeze type hangers shall be braced at the same intervals as hereinafter provided for individual pipe runs, with details increased in cross section area proportionate to the increased weight per linear foot of pipe and contents supported at each trapeze hanger. No trapeze type hanger shall be secured with less than two 1/2" bolts. Bracing rigidly attached to pipe flanges, or similar, shall not be used where it would interfere with thermal expansion of hot water piping operating at temperature above 140°F.

1.3 SWAY BRACES FOR PIPE AND CONDUITS:

A. Transverse sway bracing shall be provided at 30' intervals for pipes and conduits 8" size and smaller and at 20' intervals for larger pipes and conduits except for cast iron soil which shall be braced at 10' intervals. Reference Table 1.

B. Longitudinal sway bracing shall be provided at 40' intervals.

C. Vertical runs of copper piping 4" and smaller and steel or cast iron piping 2" and smaller, extending between floor levels or between floor and roof shall be braced at midpoint.

D. Anchor rods, angles and bars shall be bolted to either pipe clamps or pipe flanges at 1 end and cast-in-place concrete or masonry inserts or clip angles bolted to the steel structure on the other end. Rods may be solid metal or pipe as specified hereinafter.

E. Clamps on uninsulated pipes shall be applied direct. Insulated piping shall have clamps applied over insulation vapor barrier with high density inserts and metal protection shields under each clamp.

F. Bolts used for attachment of anchors to pipe and structure shall be not less than 1/2" in diameter.

1.4 TABLES

TABLE I
MAXIMUM SPAN FOR TRANSVERSE SWAY BRACES IN SEISMIC ZONE 4

Pipe Diameter	Std. Wgt. Steel Pipe – 40S		Ex. Strong Steel Pipe – 80S		Copper Tube Type L	
(in.)	*L(ft.)	**F(lbs)	*L (ft.)	**F(lbs.)	*L(ft)	**F(lbs)
1	22	70	22	80	11	17
1-1/2	25	140	26	180	12	35
2	29	220	30	290	14	70
2-1/2	32	380	33	460	15	110
3	34	550	35	710	17	150
3-1/2	36	730	38	930	18	220
4	39	960	40	1,200	19	300
5	41	1,440	44	1,900	20	470
6	45	2,120	46	2,750	22	730

*L - Maximum span between lateral supports multiplied by 1.1 for zone 3, 1.25 for zone 2, or 1.35 for zone 1.

**F - Horizontal force on the brace multiplied by 0.8 for zone 3, 0.5 for zone 2, or 0.3 for zone 1.

NOTE: Bracing shall consist of at least 1 vertical angle 2 x 2 x 16 gauge and 1 diagonal angle of the same size.

TABLE II
MAXIMUM LENGTH FOR ANCHOR BRACES

Type Brace	**Maximum Actual Length**	**Allowable Loads * (Kips)**
Angles		
1-1/2 x 1-1/2 x ¼”	4’-10”	5.7
2 x 2 x ¼”	6’-6”	7.8
2-1/2 x 2-1/2 x ¼”	8’-0”	9.8
3 x 2-1/2 x ¼”	8’-10”	10.8
3 x 3 x ¼”	9’-10”	11.9
Rods		
¾”	3’-1”	3.7
7/8”	3’-7”	5.0
Flat Bars		
1-1/2 x ¼”	1’-2”	3.1

2 x ¼”	1’-2”	4.1
2 x 3/8”	1’-9”	6.2
Pipe		
1” (Sch 40)	7’-0”	4.1
1-1/4” (Sch 40)	9’-0”	5.5
1-1/2” (Sch 40)	10’-4”	6.6
2” (Sch 40)	13’-1”	8.9

*Based on the slenderness ratio of 1/R = 200 and ASTM A 36 steel

1.5 SPREADERS:

A. Spreaders shall be provided between racked or adjacent piping runs to prevent contact during seismic activity whenever pipe or insulated pipe surfaces are less than 2" apart or 4 times the maximum displacement due to seismic force. Spreaders shall be applied to surface of bare or insulated hop pipe and over insulation utilizing high density inserts and pipe protection shields where vapor barrier type insulation is employed.

1.6 FLEXIBLE COUPLINGS OR JOINTS:

A. Flexible couplings or joints in building piping shall be provided at bottom of all pipe risers 4" size and larger. Cast iron waste and vent piping need only comply with these provisions when leaded caulked joints are used. Flexible B&S pipe joints using rubber gaskets or no-hub fittings may be used adjacent tees and elbows for underground cast iron waste piping inside buildings to comply with these requirements.

B. All underground piping in seismic zone 2 shall have flexible couplings installed adjacent to buildings. Additional flexible couplings shall be provided at all points that can be considered to act as anchors, such as all tees and abrupt changes in directions. Flexible joints specified for potable water, gas, and sanitary sewer systems, as covered by other sections of these specifications, provide the flexibility required by this paragraph.

1.7 RESILIENT VIBRATION ISOLATION DEVICES:

A. When resilient and spring type vibration devices are used to support equipment located in seismic zone 2 they shall be capable of restraining the equipment from a horizontal force equivalent to 1/4 the total weight of equipment it supports without permanent deformation or other permanent impairment of its vibration isolating function.

1.8 ANCHOR BOLTS:

A. All floor or pad mounted packaged equipment required by any section of these specifications shall use cast-in-place anchor bolts. Anchor bolts must conform to ASTM A307. Four nuts on each bolt shall be provided in seismic zone 2. Anchor bolts shall have embedded straight length equal to at least 12 times the nominal diameter of the bolt and shall conform to the following table of sizes for various equipment weights or manufacturer's recommendations, whichever is more stringent.

Maximum Equipment Weights	Minimum Bolt Sizes* (Zone 2)
500 pounds	3/8"
1,000 pounds	1/2"
5,000 pounds	5/8"
10,000 pounds	3/4"
20,000 pounds	7/8"
30,000 pounds	1"
50,000 pounds	1 1/4"
100,000 pounds	1 1/2"

*Based on 4 bolts per item, a minimum bolt spacing of 16 bolts diameter and a minimum edge distance of 12 bolts diameters. Use equivalent total cross sectional areas when more than 4 bolts per item are provided.

B. Anchor bolts which exceed normal depth of equipment foundation piers or pads shall either extend into concrete floor, or the foundation shall be increased in depth to accommodate bolt lengths.

C. Expansion anchors shall not be used to resist seismic or vibratory loads unless test data are provided to verify the adequacy of the specific anchor and application. In no case shall the expansion anchor size be less than that required for bolts in the preceding table.

D. Equipment Sway Bracing: Equipment sway bracing shall be provided for all items supported by off-the-floor structures or structures suspended from floors or roof above. Braces, shall consist of angles, rods, bars, or pipes arranged run at a 45 deg. angle as shown in detail from the equipment frame to the building structure secured at both ends with not less than 1/2" bolts. Braces shall conform to Table I hereinbefore. Bracing shall be provided in 2 planes of directions, 90 degrees apart, for each item of equipment. In lieu of diagonal of bracing with vertical support, items may be supported with hangers inclined at 45 degrees directed up and radially away from equipment and oriented symmetrically in 90-degree intervals on the horizontal plane, bisecting the angles of each corner of the equipment, provided supporting members are properly sized to support full operating weight of equipment when hangers are inclined at a 45 degree angle.

1.9 SUBMITTALS:

A. Shop drawings shall be submitted on all items in accordance with the provisions of specification Section 22 01 00.

END OF SECTION 22 05 48

SECTION 22 05 50 - NOISE AND VIBRATION CONTROL FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this section.

1.2 WORK INCLUDED

A. Provide complete noise control systems as shown or specified and in accordance with the requirements of the Contract Documents. System shall be complete with:

1. Foundations and supports for rigidly supported equipment.
2. Vibration Isolation Equipment
3. Sealing Around Services Penetrations Through Walls and Slabs

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Consult all other Sections to determine the extent of work specified elsewhere but related to this Section. This work shall be properly coordinated to produce an installation satisfactory to the Owner. This work includes, but is not limited to the following:

1. Pumps
2. Piping
3. Plumbing Fixtures
4. Concrete Housekeeping Pads
5. Noise and Vibration Control for Electrical Systems
6. Sealant

1.4 CONTRACTOR'S RESPONSIBILITY

A. The Contractor shall be responsible for verifying the completeness of the isolation installation and the overall suitability of the equipment to meet the intent of this specification. The Contractor, even if not specifically mentioned herein or in the Contract Documents, shall supply any additional equipment needed to meet the intent of this specification, without claim for additional payment.

B. Performance or waiving of inspection, testing or surveillance for any portion of the Work shall not relieve the Contractor of the responsibility to conform strictly to the Contract Documents. The Contractor shall not construe performance or waiving of inspection, testing or surveillance by the Owner or Architects to relieve the Contractor from total responsibility to perform in strict accordance with the Contract Documents.

C. The intent of the designers is that there are no conflicts between this and other sections of the specification. If conflicts are discovered between this section and any other section or subsection of Division 22, it shall be the contractor’s responsibility to immediately bring this fact to the architect’s attention and request instruction. Absent that instruction, the contractor shall assume that this current section shall overrule in any conflicts.

1.5 MANUFACTURER'S RESPONSIBILITIES

A. Manufacturer of vibration isolation equipment shall have the following responsibilities:

1. Provide piping and equipment isolation systems as scheduled or specified.
2. Guarantee specified isolation system deflection.
3. Provide installation instructions, drawings and field supervision to assure proper installation and performance.

B. The vibration isolation systems shall be guaranteed to have deflection indicated on the schedule on the drawings. The mounting manufacturer shall determine mounting sizes and the sizes shall be installed in accordance with the manufacturer's instructions.

C. The vibration isolator vendor shall ensure that all equipment to be isolated has sufficient support structure to distribute equipment loads onto isolators. Where additional support structure is required, vibration isolator vendor shall provide this.

1.6 BID PROPOSALS

A. The Contractor shall submit at the time of bidding the names and qualifications of the noise and vibration control supplier(s). If a supplier is not one of the pre-approved vendors, then the submittal shall be accompanied by a complete catalog of that supplier's products and samples of each proposed vibration isolator.

B. Contractor shall submit at the time of bidding the design octave band sound power level of each air moving device (including fans and package air handlers) as described in the Contract Documents. If the actual sound power generated by any device exceeds in any octave band the specified sound power levels for the equipment specified in the Contract Documents, the contractor shall include in his price system modifications as required to compensate for the additional noise at no expense to the Owner. Any system modification shall be subject to review and approval.

C. If the standard sizes of silencers (attenuators) offered by the supplier do not provide attenuation equal to or greater than the insertion loss specified in the schedule in each octave band 1 through 5, then at the time of bidding the supplier shall note all such discrepancies and propose how to make up the difference within the bid quote. The controlling requirements are the insertion loss, pressure drop and self-noise.

1.7 SUBMITTALS

A. Contractor shall submit fully coordinated shop drawings for all vibration and noise control equipment. These submittals shall state the acoustical performance of the products as described below.

1. Isolators: Submittal to the Architect shall include drawings *prepared by the isolation materials manufacturer* showing the construction of the isolation devices to be used, including specific selection of isolators for the equipment to be furnished for this project.

B. Submittal of vibration isolation system schedule indicating the following:

1. Manufacturer, type, model number, size
2. Height when uncompressed and static deflection of each isolation element
3. Spring constant of each isolation element
4. Estimated imposed load on each isolation element
5. Spring o. d., free operating and solid heights
6. Design of supplementary bases, if any
7. Layout of isolator hangers, mounts and other elements shown on an outline of the isolated equipment, including complete details of attachment to load-bearing structure or supplementary framing
8. Piping isolators shown and identified on piping layout drawing
9. All concrete foundations and supports (and required reinforcing and forms) will be furnished and installed by another trade. However, this trade shall furnish shop drawings showing adequate concrete reinforcing steel details and templates for all concrete foundations and supports and all required hanger bolts and other accessories necessary for the proper installation of his equipment. Although another trade will complete all concrete work, all such work shall be shown in detail on the shop drawings, prepared by this trade which drawings shall be submitted showing the complete details of all foundations including necessary concrete and steel work, vibration isolation devices, etc.

1.8 NOISE CRITICAL SPACES

A. Many areas of the building, referred to as "noise-critical spaces", require special attention (special acoustical provisions and restrictions). The table below designates the noise-critical spaces; noise levels due to equipment, ductwork, grilles, registers, terminal devices, diffusers, etc., shall permit attaining sound pressure levels in all 8 octave bands in occupied spaces conforming to NC levels per ASHRAE handbook as indicated.

1. NC Level
   a. NC 20
   b. NC 25
   c. NC 35
   d. NC 20
   e. NC 25
   f. NC 30
   g. NC 40
   h. NC 35
   i. NC 35
   j. NC 30

B. Penetrations by ducts, pipes and conduit into or between noise critical spaces should be avoided. Where they are necessary, they shall be sleeved, packed and sealed airtight with non-hardening sealant as described herein.

1.9 DESCRIPTION OF SYSTEMS

A. VIBRATION ISOLATION: Building structure can provide a direct path for mechanically induced vibration to travel from mechanical equipment to noise critical spaces. Rotating or vibrating equipment such as pumps, boilers and pipes shall be mounted on or suspended from vibration isolators to attenuate the vibration transfer from equipment into the building structure.

B. SEALING OF PENETRATIONS: Building structures meant to isolate air-borne noise surround noise critical spaces and spaces that contain noise, i.e. mechanical equipment rooms. These building structures must be massive, airtight constructions. The effectiveness of sound isolating structures can be severely compromised by penetrations for ductwork and piping. Proper sealing and/or lagging (enclosure) around mechanical services penetrating these structures will maintain the integrity of the isolating structure.

1.10 QUALITY ASSURANCE

A. It is the objective of this Specification to provide for the control of noise and vibration due to the operation of machinery or equipment, and/or due to interconnected piping, ductwork or conduit.

B. The installation of all noise and vibration control systems shall be under the supervision of the manufacturer's representative.

C. A single manufacturer shall provide all vibration isolation equipment and materials. The following manufacturers are approved provided systems are in compliance with the specified design and performance requirements. The project acoustics consultant must approve any others.

1. Mason Industries, Inc., Hauppauge, New York
2. Vibration Mountings and Controls, New Hyde Park, NY
3. Kinetics Noise Control, Dublin, Ohio

PART 2 - PRODUCTS

2.1 GENERAL

A. All equipment provided for vibration isolation or noise control shall be new and manufactured specifically for the purpose intended.

2.2 FOAM ROD

A. Foam backer rod shall be closed cell polyethylene suitable for use as a backing for non-hardening sealant.

2.3 NON-HARDENING SEALANT

A. Sealant for penetrations shall be non-hardening polysulphide type.

B. Permanently flexible, approved firestop putty may be used in lieu of the sealant on foam rod in noise critical walls that are also fire rated.

2.4 PACKING MATERIAL FOR PENETRATIONS

A. Mineral fiber; non-combustible; resistant to water, mildew and vermin. Expanding resilient foams manufactured for this purpose are an acceptable alternative only if the material density is at least 15 pcf (40 kg/m3).

2.5 VIBRATION ISOLATION SYSTEMS

A. The static deflection of isolators shall be as given in the equipment schedule and specified below. The isolator schedule shall take precedence.

1. The vibration isolator supplier shall determine vibration isolator sizes and layout.
2. All vibration isolators shall have either known undeflected heights or calibration markings so that, after adjustment, verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.
3. All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer and must be linear over a deflection range of not less than 50% above the design deflection.
4. The theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment as a whole by more than ±10%.
5. All neoprene mountings shall have a Shore hardness of 30 to 60 ±5, or as specified herein, after minimum aging of 20 days or corresponding over-aging.
6. Housed or caged spring isolators are not acceptable.
7. Where steel spring isolation systems are described in the specifications, the mounting assemblies shall utilize bare springs with the spring diameter not less than 0.8 of the loaded operating height of the spring. Each spring isolator shall be designed and installed so that the ends of the spring remain parallel during and after the spring installation. All isolators shall operate in the linear portion of their load versus deflection curve and have 50% excess capacity without becoming coil bound.
8. All mounting systems exposed to weather and other corrosive environments shall be protected with factory corrosion resistance. All metal parts of mountings (except springs and hardware) shall be hot dip galvanized. Springs shall be cadmium plated and neoprene coated. Nuts and bolts shall be cadmium plated.

B. ISOLATOR TYPE WP

1. Type WP (Waffle Pads) shall be 5/16 inch thick neoprene pads ribbed or waffled on both sides. The pads shall be manufactured with bridge bearing quality neoprene and selected for a maximum durometer of 50 and designed for 15% strain. Where required, steel load-spreading plates shall be incorporated between the equipment and the neoprene pad.
2. If the isolator is bolted to the structure, a neoprene vibration isolation washer and sleeve (Uniroyal Type 620/660 or as approved) shall be installed under the bolt head between the steel washer and the base plate.
3. (Type WP: Mason Industries Type W or as approved.)

C. ISOLATOR TYPE MWP

1. Type MWP (Metal and Waffle Sandwich Pads) shall consist of two 5/16 inch thick ribbed or waffle neoprene pads sandwiching a 16 gauge stainless steel shim plate. The pad shall be manufactured with bridge bearing quality neoprene and selected for a maximum durometer of 50 and designed for 15% strain.
2. If the isolator is bolted to the structure, a neoprene vibration isolation washer and sleeve (Uniroyal Type 620/660, or as approved) shall be installed under the bolt head between the steel washer and the base plate.
3. (Type MWP: Mason Industries Type WSW or as approved.)

D. ISOLATOR TYPE DDNM

1. Type DDNM (Double Deflection Neoprene Mounts) shall be laterally stable, double deflecting, molded neoprene isolators. All metal surfaces shall be covered with neoprene. The top and bottom surfaces shall be ribbed and bolt holes shall be provided in the base. The mounts shall have leveling bolts rigidly secured to the equipment.
2. The isolator shall be manufactured with bridge bearing quality neoprene and selected for a maximum durometer of 50 and designed for 15% strain. DDNM mounts shall be selected for a static deflection of 3/8 inch unless otherwise specified.
3. (Type DDNM: Mason Industries Type ND or as approved.)

E. ISOLATOR TYPE DDNH

1. Type DDNH (Double Deflection Neoprene Hangers) shall consist of a molded neoprene isolating element in a steel hanger box. A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 3/4 inch larger than the diameter of the hanger rod and permit the hanger rod to swing through a 30 degree arc. When installed, the hanger box shall be allowed to rotate through a full 360 degrees without encountering any obstructions.
2. The isolator shall be manufactured with bridge bearing quality neoprene and selected for a maximum durometer of 50 and designed for 15% strain. Unless otherwise specified, the static deflection of DDNH hangers shall be 0.3 inches.
3. (Type DDNH: Mason Industries Type HD or as approved.)

F. ISOLATOR TYPE RBA

1. Type RBA isolators shall be designed with a neoprene element to provide isolation in tension, shear or compression. Neoprene to bridge bearing quality with a maximum durometer of 50.
2. (Type RBA: Mason Industries Type RBA or as approved)

G. ISOLATOR TYPE SPNM

1. Type SPNM (Spring and Neoprene Mounts) shall have a free-standing and laterally stable steel spring without any housing. Springs shall be designed so that the ratio of the horizontal to vertical spring constant is between one and two. The spring diameter shall be not less than 80% of the compressed height of the spring at rated load. Loaded springs shall have a minimum additional travel to solid equal to 50% of the specified static deflection.
2. Unless otherwise specified, the minimum static deflection of SPNM isolators for equipment mounted on grade slabs shall be 1 inch and the minimum static deflection for equipment mounted above grade level shall be 2 inches.
3. Two Type WP isolation pads sandwiching a 16 gauge stainless or galvanized steel separator plate shall be bonded to the isolator baseplate.

4. Unless otherwise specified, isolators need not be bolted to the floor for indoor installations. If the base plates are bolted to the structure, a neoprene vibration isolation washer and sleeve (Uniroyal Type 620/660 or as approved) shall be installed under the bolt head between the steel washer and the base plate.
5. (Type SPNM: Mason Industries Type SLFSW or as approved.)

H. ISOLATOR TYPE SPNH

1. Type SPNH (Spring and Neoprene Hangers) shall consist of a steel spring in series with a neoprene isolating element. The spring shall have a minimum additional travel to solid equal to 50% of the specified deflection. The neoprene element shall have a static deflection of not less than 0.3 inches with a strain not exceeding 15%.
2. Unless otherwise specified, the static deflection of SPNH hangers shall be 2 inches.
3. Spring diameter and hanger box hole size shall be large enough to permit the hanger rod to swing through a 30 degree arc. A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 3/4 inch larger than the diameter of the hanger rod. When installed, the spring element shall not be cocked and the hanger box shall be allowed to rotate through a full 360 degree arc without encountering any obstructions. When installed and loaded, if the threaded rod touches the neoprene at the bottom of the hanger box, instructions shall be given to make an adjustment.
4. (Type SPNH: Mason Industries Type 30N or as approved.)

I. ISOLATOR TYPE CSNM

1. Type CSNM (Constrained Spring and Neoprene Mounts) shall be a spring and neoprene mount that incorporates a housing which incorporates unrestrained stable springs with built-in leveling device and resilient vertical limit stops to prevent spring elongation when partial load is removed and limits the movement of equipment when it is subjected to wind loading.
2. A minimum clearance of 1 inch shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring operation. Limit stops shall provide minimum 1/4” clearance under normal operation and a neoprene washer shall be installed beneath the bolt head/ washer used to restrain the isolator.
3. In installations subject to wind load, provide tapped hole in top and bottom plates for bolting to equipment and the roof or supporting structure with a neoprene mounting sleeve.
4. Provide minimum 1/4” inch thick neoprene acoustical base pad on underside of mount unless designated otherwise.
5. Mount shall be capable of supporting equipment at a fixed elevation during equipment erection. Installed and operating heights shall be identical.
6. Unless otherwise specified, the minimum static deflection for Type CSNM mounts shall be 2 inches.
7. Spring diameter and hanger box hole size shall be large enough to permit the hanger rod to swing through a 30 degree arc. A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 3/4 inch larger than the diameter of the hanger rod. When installed, the spring element shall not be cocked and the hanger box shall be allowed to rotate through a full 360 degree arc without encountering any obstructions. When installed and loaded, if the threaded rod touches the neoprene at the bottom of the hanger box, instructions shall be given to make an adjustment.

8. (Type CSNM: Mason Industries Type SLR or as approved)

J. BASE TYPE CB

1. Inertia base Type CB (Concrete Base) shall have an integral rectangular structural steel form into which concrete is poured.
2. Perimeter members shall be beams of depth equal to 10% of the longest span of the base, but not more than 12 inches nor less than 6 inches deep. Forms shall include motor slide base and all reinforcing steel. Where anchor bolt locations fall in concrete, the reinforcing steel shall include drilled members with sleeves welded below the steel to accept the anchor bolts. Height saving steel brackets shall be used in all mounting locations.
3. When the concrete base is "T" shaped, isolators shall be located under the projections as well as under the main body in order to prevent cantilever distortion.
4. The structural perimeter frame, mounting templates, height saving brackets and spring system shall be provided as an assembly by the vibration control vendor.
5. (Base Type CB: Mason Industries Type KSLFSW or as approved)

2.6 NEOPRENE MOUNTING SLEEVES

A. Neoprene mounting sleeves for hold-down applications of equipment with vibration isolators shall be Uniroyal Type 620/660 or as approved.

2.7 PIPE FLEXIBLE CONNECTORS

A. Flexible connectors for pipes shall be neoprene Mason Type MFNEC, MFTNC or as approved. Do not use control rods.

PART 3 - EXECUTION

3.1 GENERAL

A. All equipment, piping, etc. shall be mounted on or suspended from approved foundations and supports, all as specified herein, or as shown on the drawings.

B. All floor-mounted equipment shall be erected on 4" thick concrete housekeeping pads over the complete floor area of the equipment, unless otherwise specified to the contrary herein. These pads shall be integrally keyed to structural slab. Wherever vibration eliminating devices and/or concrete inertia blocks are specified, these items shall, in all cases, be in turn mounted on concrete housekeeping pads unless otherwise specified to the contrary herein.

C. Furnish and install neoprene mounting sleeves for hold-down bolts to prevent any metal to metal contact.

D. All equipment shall be provided with lateral restraining isolators as required to limit horizontal motion to 1/4" maximum, under all operating conditions. Lateral restraining isolators shall have the same having the same static deflection as equipment being isolated.

E. Unless otherwise indicated, all equipment mounted on vibration isolators shall have a minimum operating clearance of 2 inches between the bottom of the equipment or inertia

base (and height-saving bracket) and the concrete housekeeping pad (or bolt heads) beneath the equipment. The clearance shall be checked by the Contractor to ensure that no material has been left to short- circuit the vibration isolators. There shall be a minimum 4 inch clearance between isolated equipment and the walls, ceiling, floors, columns and any other equipment not installed on vibration isolators.

F. Piping, conduit or mechanical equipment shall be supported from building structure, not hung from or supported on other equipment, pipes, or ductwork.

G. Equipment connected to water or other fluid piping shall be erected on isolators or isolated foundations at correct operating heights prior to connection of piping and blocked-up with temporary shims to final operating height. When the system is assembled and fluid is added, the isolators shall be adjusted to allow removal of the shims.

H. All plumbing equipment not specifically identified in this specification that contains rotating or vibrating elements and any associated electrical apparatus installed by this division that contains transformers or inductors shall be installed on Type DDNM or RBA neoprene isolators as appropriate.

I. All wiring connections to mechanical equipment on isolators shall be made with a minimum 36 inch long flexible conduit in a 180 degree “U” shaped loop.

J. Elastomeric isolators that will be exposed to temperatures below 32 degrees F shall be fabricated from natural rubber instead of neoprene.

K. Springs shall be designed and installed so that ends of springs remain parallel and all springs installed with adjustment bolts.

L. Springs shall be sized to be non-resonant with equipment forcing frequencies or support structure natural frequencies.

M. Refer to Vibration Isolation Schedule at the end of this Section.

3.2 INLINE PUMPS

A. Inline pumps shall be supported on Type SPNM spring isolators under supports. Use elbow-type neoprene flexible pipe couplings on each side of pump. The vertical load is to be carried by the supports, not by the flexible couplings.

3.3 MOUNTING OF CENTRIFUGAL PUMPS - UNDER 2 HP

A. Pumps under 1.5 hp shall be installed on a 4” minimum thickness concrete housekeeping pad and shall be supported on at least four Type DDNM isolators.

B. Expansion TANKS and water heaters without pumps or motors

1. Each floor-mounted unit shall be supported on Type MWP neoprene sandwich pads. Each suspended unit shall be supported on Type DDNH hangers. Where piping on isolators is connected to these units, the connection shall be made with a neoprene flexible connector.

C. If an associated circulation pump is to be mounted on the unit and if the pump is 0.5 HP (0.4KW) or smaller, then the pump shall be mounted to he unit through Type RBA neoprene isolators. Such pumps larger than 0.5 HP (0.4KW) shall be supported from the

building structure on Type DDNM mounts or Type DDNH hangers. Pumps larger than 1.5 HP shall be supported on Type CIB concrete inertia bases which are supported on Type SPNM isolators. All connection to these circulation pumps shall be with flexible connections.

3.4 SUPPORT OF PIPING

A. The following water piping shall be resiliently supported:

1. All piping in equipment rooms.
2. Piping and boiler breechings outside of equipment room within 75 feet of connected rotating equipment or 100 pipe diameters whichever is greater.
3. All piping in shafts.
4. All piping where exposed on roof.

B. Resilient diagonal mountings or other approved devices shall be provided as required to limit piping motion due to equipment startup or shut down, to a maximum of 1/8".

C. Water piping hanger rod isolators shall contain a steel spring in series with a 1/4" acoustical neoprene pad within a steel box retainer. The hanger rod isolator assembly shall be rigidly supported from the spring sub assembly shall not contact the steel box retainer and clearances in the isolator design shall be capable of accepting a 15 degree misalignment in any direction from the vertical.

D. The steel spring element of the assembly shall be designed to have a minimum surge frequency of 340 HZ and a minimum deflection of 3/4".

E. Hanger rod isolators for steam and condensate piping including steam pressure reducing valve stations shall be supported by means of neoprene-in-shear mountings providing a minimum static deflection of 1/2".

F. Where supplementary steel is required to support piping, the supplementary steel shall be sized so that maximum deflection between supports does not exceed 0.08" and shall be resiliently supported from the building structure with mountings as described above. Supported piping from the supplementary steel shall be rigidly suspended or supported.

G. Pre-compressed type hanger rod isolators shall be provided for all water piping greater than 12" diameter and all supplementary steel supports. The pre-compression shall be factory set at 75% of rated deflection.

H. Where isolated water piping 8" and larger is supported directly below exposed steel beams, attachment to the beam shall be made by means of welded channel beam attachments located directly under the web of the beam. For piping 6" and smaller beam clamps may be used in lieu of welding subject to approval of beam clamp selection.

3.5 PIPING GUIDES

A. Steel guides shall be welded to the pipe at a maximum spacing of 90°. The outside diameter of the opposing guide bars shall be smaller than the inside diameter of the pipe riser clamp in accordance with standard field construction practice. Each end of the pipe guide shall be rigidly attached to an all directional pipe anchor isolation mounting which in turn, shall be rigidly fastened to the steel framing within the shaft. See Detail on Drawings.

B. The all directional pipe anchor isolation mountings shall consist of a telescoping arrangement of two sizes of steel tubing separated by a minimum of 1/2" thick heavy duty neoprene and canvas duct isolation pad. Vertical restraints shall be provided by similar material arranged to prevent vertical travel in either direction. The allowable load on the isolation material shall not exceed 500 psi.

C. Low temperature piping guides shall be constructed with a 360 degree 10 gauge metal sleeve around the piping. The thermal insulation requirements for the piping shall be provided between the piping and the sleeve. Heavy duty neoprene and canvas duct isolation pad of thickness equal to thermal insulation requirements shall space the metal sleeve away from the piping with urethane or other suitable thermal insulation provided in the voids between the pipe-sleeve and isolation pan material. The metal sleeve outside diameter shall be smaller than the pipe riser clamp inside diameter in accordance with standard field construction practice. The pipe riser clamp shall be rigidly attached to the steel framing within the shaft.

3.6 ANCHORS

A. The pipe riser clamp at anchor points, shall be welded to the pipe and to pairs of vertical acoustical pipe anchor mountings which in turn, shall be rigidly fastened to steel framing in the pipe shaft.

B. Acoustical pipe anchor mountings shall be Type ADA Mason Industries, Inc., or as approved.

3.7 SUPPORTS

A. Piping supports within shafts shall be provided with suitable bearing plates and two layers 1/4" thick ribbed or waffled neoprene pad loaded for 50 psi maximum. The isolation pads shall be separated with 1/4" steel plate.

B. The isolation pads shall be Mason Industries Type W or approved equal.

C. Piping isolation supports at the base of risers shall be two layers of 1/2" thick heavy duty neoprene and canvas duct isolation pad separated by 1/4" thick steel plate. Suitable bearing plates sized to provide a pad loading of 500 psi maximum shall be provided. The stanchion between the pipe and isolation support shall be welded to the pipe and welded or bolted to the isolation support. The isolation support shall be bolted to the floor slab with resilient sleeves and washers.

D. All pipe support resilient materials shall be HL Mason Industries, Inc., or as approved.

3.8 PIPES CONNECTED TO EQUIPMENT ON SPRING ISOLATORS

A. All pipes connected to equipment installed on spring vibration isolators, except sprinkler piping, shall be suspended or, supported by Type SPNM or Type SPNH isolators. Provide vibration isolation anchors and guides as specified elsewhere in this specification.

B. The first isolator both upstream and downstream of equipment on springs shall have a static deflection equal to 1.5 times that of the equipment isolators, up to a maximum of 2 inches. The static deflection of the remaining pipe isolators shall be 1 inch.

C. If pipes are supported on noise-critical structure, the 1.5 times spring deflection rule above applies throughout the pipe run.

3.9 PIPES CONNECTED TO EQUIPMENT ON NEOPRENE ISOLATORS

A. Piping that is connected only to machinery installed on neoprene isolators shall be either supported from the floor on Type DDNM mounts or suspended from the structure on Type DDNH hangers.

3.10 PIPES WITH MULTIPLE CONNECTIONS

A. Where a pipe run connects multiple items of equipment in the mechanical room the pipe isolators for the entire run shall be chosen to suit the connected equipment of greatest static deflection.

3.11 FLEXIBLE PIPING CONNECTORS

A. Twin-sphere neoprene type flexible piping connectors shall be installed to connect piping to reciprocating or rotating equipment.

3.12 DRAIN PIPES, VENT PIPES AND SMALL DOMESTIC WATER PIPES

A. Except as noted elsewhere on this specification, outside the mechanical room all compressed air and domestic hot and cold water pipes with a diameter less than or equal to 2 inches shall be isolated from the structure with sponge neoprene, felt or glass /mineral fiber sleeves between the pipe and pipe clamp or with Type WP pads between the clamp and the structure. When it is compressed, the sleeve shall be not less than 1/8 inch in thickness.

3.13 PIPE RISERS

A. Where pipes rise in a vertical chase and are supported from a structure with type SPNH or DDNH isolators and require lateral bracing, neoprene riser guides shall be mounted around the pipe to limit lateral movement and to prevent direct contact with the supporting structure.

3.14 PIPE PENETRATIONS

A. DOMESTIC WATER, SEWER, DRAIN AND VENT PIPING

1. Where a pipe passes through a wall, ceiling or floor slab, a steel sleeve shall be cast or grouted into the structure. The internal diameter of the sleeve shall be 2 inches larger than the external diameter of the pipe passing through it. After all of the piping is installed in that area, the Contractor shall check the clearance and correct it, if necessary, to within 1/2 inch. Then the void shall be packed full depth with glass /mineral fiber and sealed at both ends, 1 inch deep, with sealant backed by foam rod.
2. Penetration of sound isolating ceilings by sprinkler pipes and heads shall be sleeved and sealed as described herein. There shall be no rigid connection between ceiling and pipes or heads.

3.15 WIRING

A. All wiring connections to plumbing equipment on vibration isolators (either spring or neoprene type) shall be made with a minimum 36 inch (1m) long flexible conduit in a 180

degree “U” shaped loop. This Contractor shall coordinate wiring connections with the Electrical Contractor.

3.16 FIELD QUALITY

A. Contractor shall work in accord with best trade practices, shall fabricate and install all items in accordance with manufacturer's recommendations and Architect's directions and shall consult with trades doing adjoining work in order to provide an installation of first class quality.

3.17 ADJUSTMENT AND TESTING

A. SITE ACCESS: During installation of equipment, Contractor shall arrange for access as necessary for inspection of isolation and noise control equipment by Architect and his representatives.

B. CONTRACTOR'S REPORT: The vibration isolation vendor shall inspect and approve the installation of the vibration isolators and shall submit a report to the Owner, which verifies that all of the isolation equipment has been properly installed and that the installation is in full conformance with the specification. The report shall record the vibration isolator identification and model or type. For isolators containing steel springs the report shall also record the size and uncompressed height, design static deflection and measured static deflection of the isolators provided.

C. CONSULTANT'S INSPECTION

1. Upon completing installation and adjustment for suitable operation of all work specified under this section, the Contractor shall notify the Architect in writing. The letter shall certify that all work specified under this section is complete, operational and adjusted in every respect and that all work is ready for the completion checkout. A copy of the air balancing report and the vibration isolation report shall accompany the notification letter.
2. Upon notification of completion, Architect will schedule an inspection by the Acoustics Consultant, who will measure the background noise level with all Mechanical Systems running.
3. For each inspection, Contractor shall perform such functions as are necessary for inspection of the equipment. Background noise level testing must be carried out during late-night hours when ambient noise from outside is at a minimum and the site is otherwise not occupied and no work is under way. Contractor shall turn on and off any and all mechanical equipment during such background noise level testing.

3.18 GUARANTEE

A. If, in the actual installation, any equipment fails to meet the noise or vibration control requirements specified herein, that equipment shall be corrected or replaced without claim for additional payment, inclusive of all labor and material costs. Such corrective measures shall be done within a time schedule specified by the Owner.

VIBRATION ISOLATION SCHEDULE FOR PLUMBING EQUIPMENT				
EQUIPMENT	**BASE TYPE**	**ISOLATOR TYPE**	**STATIC DEFLECTION**	**REFERENCE DETAIL**
Base-mounted pumps (less than 3 HP)		DDNM	.4”	
Piping		Isolation as per specification	2” default	

END OF SECTION 22 05 50

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section describes the requirements for testing and balancing of all piping and equipment installed under this contract in the presence of the Engineer and the State Inspector and prove tight for the periods stated below or longer if required for inspection.

1. Disconnect the apparatus for developing the required pressures during the stated periods.
2. Completely disconnect and remake joints that leak.
3. No plumbing system or part thereof shall be covered or concealed until after it has been tested and approved.
4. If such work has been covered or concealed before testing, it shall be exposed for testing.
5. If tests described in the specifications for plumbing systems differ from requirements or the local inspector, the more rigid requirements shall govern.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Testing:
1. Rough sanitary, vent and storm water piping:
2. Stop all openings and fill with water to the top of the highest vent.
3. Water level shall hold constant for two hours.
4. Soil, storm waste, and vent systems: May be tested in sections using the water pressure test. Test pressure shall be equal to at least 10 ft. water column at all points. Retest at least the upper 10 feet of the lower section.

2.2 WATER SUPPLY SYSTEM:

A. Fill and subject to 150 PSIG hydrostatic pressure at the lowest level for (2) hours. Fixtures shall not be connected, test the system for two hours at 75 PSIG or the prevailing water pressure, whichever is higher.

2.3 BALANCING:

A. Regulate the flow of water to each fixture so that the faucets and flush valves operate satisfactorily without waste of water and without objectionable noise.

B. All piping shall be free from objectionable noise or vibration and the circulation through same free and easy under normal operation and peak loads.

C. Adjust the hot water recirculation balancing valves to obtain approximately equal temperature drops through each section of the mains.

END OF SECTION 22 05 93

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PART 1 - GENERAL

1.1 SCOPE:

A. This work includes cleaning the various fluid systems, pressure testing to insure tightness, and start-up of the various systems to prove their operational capability.

PART 2 - PRODUCTS

2.1 CLEANING OF SYSTEMS:

A. Clean all piping systems, equipment and accessories (especially pumps, valves, flange faces, gauges, etc.) of cutting chips and foreign matter while installing.

B. Portable water chlorination certificate shall be provided by the plumbing contractor and made available to the State Construction Office at the time of final inspection. Certificate shall become part of closeout documents.

2.2 GENERAL:

A. Be careful to provide all sight glasses, control valve, pumps and any items that could be damaged by foreign material with 40 mesh screen on the inlet side or bypass, or remove such items.

B. Clean out all low velocity areas where dirt accumulated.

C. Protect all water systems from freezing.

D. Clean all strainers and dirt legs.

2.3 START-UP AND TEST:

A. Each system shall be started-up and a preliminary test made as follows:

1. This contractor shall make trial runs of each piece of equipment furnished by him. This contractor shall provide all oil, grease and other lubricants for the operation of all equipment until acceptance. This contractor shall be held responsible for all damage to bearing while the equipment is being operated by him up to date of acceptance of the equipment, and for a period thereafter as per the general building warranty. The subcontractor shall be required to protect all bearings during installation and shall thoroughly grease steel shafts to prevent corrosion.

2. The contractor shall align each shaft and adjust all pulleys to run substantially vibration free. Where equipment cannot be so adjusted by the contractor, the manufacturer shall provide a machinist or serviceman to make these adjustments. Vibration free is construed to mean that rotating machinery shall not exceed a self-excited vibration velocity of 0.10 inches per second in any direction when measured with a vibration meter on the bearing caps of the machine.

3. Belts shall be checked for alignment and tightened to proper tension.

4. Overload elements in motor starts shall be checked and proper elements provided as required for the motor full load amp rating.

5. Glands, seals, etc. shall be examined and properly adjusted.

6. Air vents shall be bled.

7. Equipment shall be started per manufacturer's instructions and run in.

8. Read amperage and voltage on each motor the first time it is started and check direction of rotation.

B. Run an operating test on each piece of equipment. The tests shall be sufficient to show that the equipment has been run and observed and shall include the following:

1. Volts and amps on each motor.

2. Results of preliminary tests shall be submitted before test and balance subcontractor commences his work.

END OF SECTION 22 05 95

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Provide insulation as specified for: Piping systems including valves, couplings, fittings, flanges, strainers, and expansion joints.

1. Equipment, including tanks, and components subject to heat loss or heat gain.
2. Other items where shown on drawings and/or specified.

1.2 SUBMITTALS:

A. Shop drawings shall be submitted on all items in accordance with the provisions of specification Section 22 01 00.

1.3 RELATED WORK SPECIFIED ELSEWHERE:

A. In addition to this Section, this sub-contractor shall refer to other specification sections and drawings to ascertain the extent of work, including all Division 22 Sections.

1.4 DEFINITION:

A. Work under this Division 22 of the specifications shall include but not necessarily be limited to items common to Sections:

1. 22 07 02 Potable Cold Water and Storm Piping Insulation
2. 22 07 04 Potable Hot Water and Recirculating Piping Insulation

1.5 QUALITY ASSURANCE:

A. Provide piping insulation products produced by one of the following manufacturers for each type and temperature range of insulation.

1. Certainteed Corporation
2. Owens-Corning Fiberglass Corporation
3. Knauff Corporation
4. Armstrong Cork Company

1.6 SUBMITTALS:

A. Shop drawings shall be submitted on all items in accordance with the provisions of specification Section 22 01 00.

B. Submit shop drawings on the following:

1. Insulation
2. Fitting covers

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged insulation; remove from project site.

B. Delivery insulation, covering, cements, adhesives and coatings to the site in factory-fabricated containers with the manufacturer's stamp, or label, affixed showing fire hazard ratings of the products.

C. Store insulation in original wrappings and protect from weather and construction traffic.

PART 2 - PRODUCTS:

2.1 GENERAL PRODUCT REQUIREMENTS - PIPING INSULATION:

A. Insulation shall have composite (insulation jacket or facing, and adhesive used to adhere the facing or jacket to the insulation) fire and smoke hazard ratings as tested by procedure ASTM E84, NEPA 255 or UL 723 not exceeding:

1. Flame Spread-25Smoke Developed 50

B. Accessories such as adhesives, mastics, cements, tapes and cloth for fittings shall have the same component rating as listed above. All products or their shipping cartons shall bear a label indicating that flame and smoke ratings do not exceed requirements. Treatment of jackets or facings to impart flame and smoke-safety shall be permanent. The use of water-soluble treatments is prohibited.

C. Where Benjamin-Foster adhesives are specified equal products manufactured by 3M Company, or the manufacturer of the insulation are acceptable upon approval by the Engineer. Armstrong 520 adhesive shall be used for Armstrong insulation.

D. In lieu of the insulation wrap specified for fittings, valves, mechanical couplings and flanges, unitary type insulation products similar to J-M Unifit shall be acceptable.

PART 3 - EXECUTION:

3.1 GENERAL EXECUTION REQUIREMENTS - PIPING:

A. Insulation shall be applied on clean dry surfaces, after inspection and release for insulation application. Items that are factory insulated shall not receive additional insulation.

B. Insulation shall be continuous through non-rated wall and ceiling openings and sleeves.

C. Insulation on cold surfaces where vapor barrier jackets are used shall be applied with a continuous, unbroken vapor seal. Anchors, etc., that are secured directly to cold services shall be adequately insulated and vapor sealed to prevent condensation.

D. Where insulation is specified for piping, insulate similarly all connections, vents, drains, and any appurtenances and piping connected to system subject to heat loss

or gain. Unions, couplings, or flanges provided at equipment for removal of heat exchanger, etc., shall be insulated with removable molded blocks.

E. Where inserts occur at pipe supports and guides, provide the following:

1. On hot pipe apply 3" wide vapor barrier tape or band over the butt joints.
2. On cold pipe apply a wet coat of vapor barrier lap cement on all butt joints and seal all joints with 3" wide vapor barrier tape or band.

F. Fittings, valves, mechanical couplings and flanges shall be insulated with the same material and of the same thickness as the adjoining piping, except where otherwise specified.

G. Concealed piping insulate with glass fiber insulation types shall be banded in place with three aluminum bands per section, one over each end of the joint sealing strip, and one in the middle of the section.

H. All exposed piping shall be finished with an 8 ounce canvas jacket posted to the insulation and if within 8'-0" of the floor shall be finished with an additional aluminum jacket (.016" preformed). Exposed fittings, etc. shall be finished with fitting cloth smoothly adhered and coated with Benjamin-Foster 30-36. Lap the cloth on itself and adjoining pipe insulation. Lap to be at least 1" on pipe insulation below 4" and 2" on sizes 4" and above.

I. On pipe sizes 4" and larger, fittings, mechanical couplings, and valves shall be insulated with molded fitting covers. Flanges shall be insulated with sectional pipe insulation extending a minimum of 1" beyond the end of the bolts. Bolt area shall be fitted with insulating and finishing cement.

J. All piping subject to freezing such as in outdoor air or discharge plenums or outdoors shall be insulated with twice the insulation thickness specified.

3.2 GENERAL EXECUTION REQUIREMENTS - EQUIPMENT:

A. Insulation shall be firmly held in place with galvanized steel wire or galvanized steel bands on 12" centers.

3.3 PROTECTION AND REPLACEMENT:

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation installer shall advise plumbing contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 22 07 00

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PART 1 - GENERAL:

1.1 SCOPE OF WORK:

A. Provide insulation as specified for cold water piping systems, including valves, mechanical coupling, fittings, flanges and strainers.

1. Other items where shown on drawings or as specified.

PART 2 - PRODUCTS

2.1 PIPING INSULATION TYPES:

A. Type P-1 Pipe Insulation:

1. Insulation shall be glass fiber with a maximum K factor of .24 at 75°F mean temperature with factory applied fire resistant vapor barrier jacket.

2. For fittings and valve bodies 3" and smaller, insulation shall be one-pound density glass fiber blanket wrapped firmly under compression with No. 20 gauge galvanized annealed steel wire and given a smoothing coat of finishing cement.

3. Insulation Thickness Schedule:

	Piping System	Thickness
a.	Potable Cold Water Supply	1" Min.

B. Type P-2 Pipe Insulation:

1. Insulation shall be the same as Type 1 except fittings and valves 3" and smaller shall be insulated and finished with insulation and finishing cement to a thickness equal to the adjoining pipe insulation.

2. Insulation Thickness Schedule:

	Piping System	Thickness
a.	All horizontal storm drain above ground (primary & secondary)	1"
b.	All roof drain bodies (primary and secondary)	1"

PART 3 - EXECUTION

3.1 PIPING INSULATION:

A. Type P-1 Insulation:

1. Longitudinal lap and 4" wide vapor barrier joint seal strips shall be adhered neatly in place with BF 85-20 adhesive or approved equal.

2. The ends of pipe insulation shall be sealed off with BF 30-35 coatings at all open ends, flanges, valves and fittings and at intervals of not more than 21 feet on continuous runs of pipe.

3. Fittings shall be vapor sealed by applying a layer of white open weave glass fabric (20 x 20) between two 1/16" thick coats of BF 30-35.

B. Type P-2 Insulation:

1. Type P-2 insulation shall be installed as P-1 above exception that insulation end not be vapor sealed.

END OF SECTION 22 07 02

SECTION 22 07 04 - POTABLE HOT WATER AND RECIRCULATING PIPING INSULATION

PART 1 - GENERAL:

1.1 SCOPE OF WORK:

A. Provide insulation as specified for hot water piping systems, including valves, mechanical coupling, fittings, flanges and strainers.

B. Equipment and components subject to heat transfer including:

1. Other items where shown on drawings or as specified.

PART 2 - PRODUCTS

2.1 PIPING INSULATION TYPES:

A. Type P-3 Pipe Insulation:

1. Insulation shall be molded glass fiber with a maximum K factor of 0.24 at 75°F mean temperature with factory applied Fire Retardant Jacket.

2. For fittings and valves bodies 3" and smaller, insulation shall be one-pound density glass fiber blanket wrapped firmly under compression with No. 20 gauge galvanized annealed steel wire and given a smoothing coat of finishing cement.

3. Insulation Thickness Schedule:

Piping System	Pipe Size	Thickness
Potable Hot Water Supply	0 – 2 ½”	1”
Recirculating Return (100°F to 290°F)	3” and larger	1 ½”

2.2 EQUIPMENT INSULATION TYPES:

A. Type E-2 Equipment Insulation:

1. Insulation shall be 6# per cubic foot density glass fiber with fire retardant vapor barrier facing and having a maximum K factor of 0.24 at 75°F mean temperature.

2. Sections of equipment requiring periodic servicing shall be insulated with removable ArmourCote covers as manufactured by Insulcoustic Corp. or by Sheet Metal Casing with insulation applied to the interior surface of the casing.

END OF SECTION 22 07 04

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PART 1 - GENERAL:

1.1 SCOPE OF WORK:

A. This work shall consist of furnishing all labor, material, equipment, and services necessary for the installation of all equipment specified hereinafter. Equipment and components principally relevant to this section include:

1. In-line centrifugal pumps
2. Other items where shown on the drawings or as specified.

PART 2 - PRODUCTS:

2.1 IN-LINE CENTRIFUGAL PUMPS:

A. Centrifugal, direct connected, completely bronze fitted and bronze body.

B. Motors shall be capacitor type mounted on isolated supports or base mounted.

C. Shaft shall be phosphor bronze of stainless steel with integral thrust collar for vertical mounting if in-line type.

D. Bearings shall be self-lubricating, sleeve type with positive mechanical seal.

E. Motor speed shall be 1800 RPM maximum.

F. Bell & Gossett, no equals

PART 3 - EXECUTION

3.1 GENERAL:

A. The Contractor shall furnish in duplicate a factory curve showing actual test head-capacity characteristics of the pumps where indicated. It will not be required that this curve be certified but the manufacturer shall state that it is not a stock curve sheet but is the result of actual shop test.

B. Mounting shall be as described under "Vibration Isolation."

C. Final alignment to be done after piping is completed, before start-up by manufacturer's representative. Alignment shall be made with dial indicator to a tolerance of ±.002."

D. Provide piping; accessories, hangers, supports, and anchors; valves; meters and gages; vibration isolation; and equipment supports; as indicated for complete installation.

END OF SECTION 22 11 01

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PART 1 - GENERAL:

1.1 SCOPE OF WORK:

A. This work shall consist of furnishing all labor, material, equipment, and services necessary for the installation of all equipment specified hereinafter.

B. Equipment and components principally relevant to this section include:

1. Thermometers
2. Pressure gauges and gauge cocks
3. Other items where shown on the drawings or as specified.

PART 2 - PRODUCTS:

2.1 THERMOMETERS:

A. Thermometers shall be red, reading, adjustable angle thermometers complete with sensing elements.

B. Sockets shall have extended necks for insulated lines.

C. Separable thermometer wells shall be provided for all controller bulbs in pipes or tanks. The thermometer well shall be so located that it will be completely surrounded by the flowing fluid, and shall be of suitable size for the instrument served.

D. Case shall be cast aluminum with standard glass front, black numerals on white background.

E. Sensing element shall be brass, with brass stem extension and with brass separable socket where required.

F. Weksler numbers have been used to establish the type and quality desired. Palmer, H.O. Trerice or Taylor Company equipment are equally acceptable.

2.2 PRESSURE GAUGES AND GAUGE COCKS:

A. Cases and rings shall be aluminum alloy back mounted or pipe mounted as required; pipe mounted type shall be without mounting flange.

B. Dials shall be white and black numerals and graduations. Pointer shall be black, accurately balanced.

C. Movement shall be bronze bushed, gear operated, bronze bourdon tube.

D. Ashcroft gauges have been used to establish the desired type and quality. Palmer, W.O. Trerice or Taylor equipment shall be equally acceptable.

E. For every gauge installed provide a gauge cock on a nipple of sufficient length that the cock handle will be free of the pipe insulation. Each cock shall be so positioned in relation to the surrounding pipe and equipment that the gauges specified can be screwed into and out of it. Provide similar gauge cocks where indicated so that test

gauges may be screwed into them. Additional pressure gauge connections shall be provided at all points required by the Test and Balance Subcontractor. Gauge cocks shall be Crane No. 774 or 712, or Schrader quick-connect valves. Equal: Grinnel, Nibco.

F. All gauges piping shall be type L seamless copper tubing with sweat type wrought or cast fittings, or Contractor's option Schedule 40 black steel piping may be used.

PART 3 - EXECUTION

3.1 INSTALLATION OF THERMOMETERS:

A. Whenever a thermometer or controller bulb is inserted in a pipe for either remote or local temperature indication or control, the thermometer wells shall be so located that it will be completely surrounded by flowing fluid. Such thermometer locations as are shown on the plans are purely diagrammatic. The plumbing contractor shall install thermometer wells for maximum effectiveness and, in the case of locally indicating instruments, for easy readability. All wells shall be installed in a vertical or 45 degree up position. All thermometers and gauges shall be installed in such a location and position that they can easily be read by personnel standing on the floor.

B. Thermometers shall be installed to be easily read from floor level, not over 8'-0" above floor. Where higher mounting heights are necessary, remote reading type shall be substituted for model specified.

C. Thermometers shall be provided as follows and where indicated on plans for Division 22 work:

Serves	Location	Size	Range	Divisions	No.
Hot water heating system	Supply & return at each floor	12”	0-220F	2F	Weksler AA-5
Recirculating pump	On discharge	12”	0-220F	2F	AA-4

3.2 INSTALLATION OF PRESSURE GAUGES:

A. Install a suitable pressure gauge where shown on the drawings. Install on a gauge cock. Install steam pressure gauges on pigtail loops. Install pump pressure gauges with vibration snubbers.

B. All gauges shall be installed so they are completely readable by a person standing on the floor.

C. All gauges shall be mounted at points where protection is provided from damage by maintenance and construction personnel. Gauges shall be mounted to be easily read from floor. Gauges mounted over 8'-0" above the floor shall be enlarged one size listed on schedule.

D. Pressure gauges shall be provided as follows and where indicated on plans for Division 22 work.

Serves	Location	Size	Range PSI	Inter Grad	Figure Intervals	Ashcroft
Domestic water pressure	On incoming service	4.5”	0-200	2 PSI	20 PSI	1010
Domestic water pressure	Leaving side of pressure reg. valve	4.5”	0-200	2 Psi	20 PSI	1010
Recirculating pump	On inlet & discharge piping	4.5”	0-200	2 Psi	20 PSI	1010

END OF SECTION 22 13 01

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PART 1 - GENERAL:

1.1 SCOPE OF WORK:

A. This work shall consist of furnishing all labor, material equipment and services necessary for the installation of all equipment specified hereinafter.

B. Equipment and components principally relevant to this section include:

1. Escutcheons
2. Air Vents
3. Unions
4. Strainers
5. Other items where shown on the drawings or as specified.

PART 2 - PRODUCTS:

2.1 ESCUTCHEONS:

A. Chrome plate, stamped steel, hinged, split-ring escutcheon, with set screws. Inside diameter shall closely fit pipe outside diameter, or outside of pipe insulation where pipe is insulated. Outside diameter shall completely cover the opening in floors, walls, or ceilings.

2.2 AIR VENTS:

A. Manual vent - Brass petcock, 1/4" size, with threaded flare fitting for drain tubing connection.

2.3 UNIONS:

A. Unions shall be of malleable iron, ground joint type for steel pipe, or brass for copper tubing, installed at all tanks, etc. Where piping system is composed of dissimilar metals, copper and steel, etc., furnish and install insulating unions, dielectric type Epco FX and GX or Water Gallatt insulating couplings. For mains install on dielectric union at building entrance.

2.4 STRAINERS:

A. All strainers in piping (including all pump inlets) shall be Y-pattern, set in a horizontal (or vertical downward) run of the pipe. Where this is not feasible, strainers may be of enlarged-cross-section type. Strainers shall be arranged as not to "trap" lines and to facilitate disconnection and opening up for cleaning. Unless otherwise indicated, strainers shall be line size.

B. All strainers shall have cast iron, semi-steel or bronze bodies of ample strength for the pressure to which they shall be subjected, removable cylindrical or conical screens of monel or stainless steel and suitable flanges or tappings to connect with the piping they serve. They shall be of such a design as to allow blowing out of accumulated dirt, and to facilitate removal and replacement of a strainer screen, without disconnections of the main piping.

2.5 DIELECTRIC WATERWAY FITTINGS:

A. Electroplated steel or brass nipple, with an inert and non-corrosive, thermoplastic lining.

B. Screens shall be monel with perforations as follows:

1. 2" and smaller - .045"
2. 2-1/2" - 5" - .057"with 30 mesh screen
3. 6" and larger - 5/32" with 30 mesh screen

C. Dielectric Waterway Fitting Caps: Electroplated steel or brass nipple, with inert and non-corrosive, thermoplastic lining.

PART 3 - EXECUTION:

3.1 INSTALLATION OF AIR VENTS:

A. Provide at all high points of systems where required and/or shown on plans as follows:

1. All vents shall be manual type unless otherwise shown or specified.
2. Install vents so they are easily accessible. Provide access doors where required.
3. Install in tee at all high points of mains and risers. Provide 1-1/4" x 6" air collection chamber to which air vent is to be connected.
4. When piping is concealed, connect 1/2" copper tubing to collection chamber and mount manual valve near access door.

3.2 INSTALLATION OF STRAINERS:

A. There shall be approved strainers in the inlet connection to each pump, and each automatic steam valve, and elsewhere as shown on drawings. The intention is to protect by strainers all apparatus of an automatic character whose functioning would be interfered with by dirt or debris.

B. Provide approved valved dirt blow off connections for each strainer with the valve located 6" below strainer or as directed. Nipples and valves to be full size of strainer except 1" maximum size blow off tapping. For all strainers, the blow out connection is to terminate in an approved manner, at a point where there will be no risk of flooding or damage.

END OF SECTION 22 21 13

PART 1 - GENERAL:

1.1 RELATED DOCUMENTS:

A. The general provisions of Contract, including General and Supplementary Conditions and General Requirements apply to work specified in this section.

1.2 SCOPE OF WORK:

A. This work shall consist of furnishing all labor, material, equipment, and services necessary for the installation of all equipment specified hereinafter.

1.3 SHOP DRAWINGS:

A. Shop drawings shall be submitted on all equipment including the following:

1. Domestic Water Heaters
2. Hot Water Recirculating Pumps
3. Other items where shown on the drawings or as specified.

B. All equipment manufacturers shall be made by company with not less than 5 years successful service in this country and in similar installments.

PART 2 - PRODUCTS:

2.1 DOMESTIC HOT WATER HEATER – GAS:

A. Water heater shall be Model as manufactured by Lochinvar, A. O. Smith, Rheem or equivalent equal submitted prior to bid. Water heater shall be a powered fire power burner with electronic flame safequard, electronic programmed flame safeguard, electronic flame monitoring with and direct spark ignition. Heater shall have an input rating of “scheduled” BTU/Hr and a recovery rating of “scheduled” gallons. Heater shall have an ASME working pressure of 160 PSI, and stamped National Board. Controls shall include: high temperature limit control (manual reset), upper and lower thermostats, combination temperature and pressure gauge, low water cutoff, ASME rated temperature and pressure relief valve. Control compartment door shall be hinged for easy access. The heater shall be insulated with a vermin-proof glass fiber insulation or equal. Heater must meet ASHRAE 90A-1980 (1982 requirements) for recovery efficiency and standby loss. The outer jacket shall have a baked enamel finish over a bonderized undercoating. The water heater shall have a solid copper heat exchanger. Heater tank shall have a 3-year limited warranty against corrosion as outlined in the written warranty.

2.2 HOT WATER RECIRCULATING PUMP:

A. Refer to hot water recirculating pump schedule for GPM, head voltage.

PART 3 - EXECUTION

3.1 INSTALLATION OF GAS DOMESTIC WATER HEATERS:

A. Install gas-fired water heaters as indicated, in accordance with manufacturer's installation instructions, and in compliance with applicable codes.

B. Support: Set units on concrete pads, orient so controls and devices needing service and maintenance have adequate access. Level and plumb unit.

C. Piping: Connect hot and cold water piping to units with shutoff valves and unions. Connect recirculating water line to unit with shutoff valve, check valve, and union.

D. Flue: See mechanical drawings and specifications.

E. Start-Up: Start-up, test, and adjust gas-fired water heaters in accordance with manufacturer's start-up instructions, and Utility Company's requirements. Check and calibrate controls, adjust burner for maximum efficiency.

3.2 INSTALLATION OF HOT WATER RECIRCULATING PUMP:

A. General: Install recirculating pump as indicated, in accordance with manufacturer's installation instruction, and in compliance with applicable codes.

B. Support: Provide support per manufacturer's instructions, orient so devices needing service and maintenance have adequate access. Level and plumb unit.

C. Electrical Supply: Furnish wiring diagram to electrical installer. Refer to Division 26 for wiring if units; not work of this section.

D. Piping: Connect recirculating water line to pump with shutoff valve, check valve, balancing cock, and unions.

E. Start-up: Start-up, test and adjust recirculating pump in accordance with manufacturer's start-up instructions.

END OF SECTION 22 33 00

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. This work shall consist of furnishing all labor, material, equipment, and services necessary for the installation of all equipment specified hereinafter.

1.2 SHOP DRAWINGS:

A. Shop drawings shall be submitted on all equipment including the following:

1. Fixtures
2. Cleanouts
3. Trim
4. Floor Drains
5. Flush Valves
6. Hose Bibbs
7. Seats
8. Wall Hydrants
9. Carriers
10. Back flow preventers
11. Other items where shown on the drawings or as specified.

B. All fixtures equipment and trim shall be made by company with not less than 5 years successful service in this country and in similar installments.

1.3 FIXTURES:

A. All vitreous china fixtures shall be 2 fired, conforming in all respects to the standards adopted by the Vitreous China Fixtures Manufacturers Advisory Committee.

B. Unless otherwise specified all vitreous china fixtures shall be white.

1.4 HANGING:

A. Fixtures designed for wall mounting shall be provided with supports complete with all couplings, gaskets, anchors, etc. for compatible installation with fixtures provided.

B. Wax gaskets shall not be used on fixtures receiving hot water.

1.5 PIPING AND TRIM:

A. All exposed piping and trim, traps, valves, tail-pieces, faucets and fittings shall be chrome finished and shall be made of copper or copper alloy. P-traps shall be made of chrome-plated cast brass.

PART 2 - PRODUCTS

2.1 FIXTURES SCHEDULE:

A. The following list and description of fixtures are from Kohler. Similar fixtures as manufactured by American Standard or Toto will be acceptable for approval. Stainless steel fixtures shall be 18-gauge type 302 nickel-stainless steel by Elkay. Similar fixtures by American Standard or just will be acceptable for approval. Note: PC to supply template to counter manufacturer for proper hole cutting.

B. Seats shall be as manufactured by Olsonite. Similar seats by Beneke, Bemis, or Church will be acceptable for approval. All seats shall have open front, concealed check stops and self-sustaining features.

C. Faucets and trim shall be as manufactured by Kohler. All screws and index buttons shall be vandal-proof. Similar faucets and trim by Delta or Chicago Faucet Co. will be acceptable for approval.

2.2 MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering plumbing fixtures and trim which may be incorporated in the work include, but are not limited to, the following:

Product	Manufacturers
Plumbing Fixtures	American Standard Crane Co. Eljer Plumbingware Kohler, Co.
Faucets	Chicago Faucet Co. Zurn Plumbing Products T&S Brass and Bronze Works, Inc.
Flush Valves	Sloan Royal Sloan Royal XL
Fixture Seats	Bemis Mfg. Co. Beneke Corp. Olsonite Seats
Water Coolers	Oasis Mfg. Co. Elkay Mfg. Co. Halsey Taylor Div Acorn/Aqua Co.
Service Sinks	American Standard Crane Co. Eljer Plumbingware Fiat Products Stern-Williams Co., Inc.
Stainless Steel Sinks	Elkay Mfg. Co. Just Mfg. Co. Moen, Div of Stanadyne/Western
Fixture Carriers	Josam Mfg. Co. JR Smith Tyer Pipe Zurn Industries Wade

P-1	**Water Closet**	
	Note:	See Plumbing Fixture Schedules on Drawing P001.

P-1a	**Water Closet (Handicap)**	
	Note:	See Plumbing Fixture Schedules on Drawing P001.

P-2	**Urinal**	
	Note:	See Plumbing Fixture Schedules on Drawing P001.

P-2a	**Urinal (Handicap)**	
	Note:	See Plumbing Fixture Schedules on Drawing P001.

P-3	**Lavatory (Handicap)**	
	Note:	See Plumbing Fixture Schedules on Drawing P001.
	Drain	Grid Strainer with 1-1/4” tailpiece
	Trap	1-1/4” x 1-1/2” 17 ga tubular adjustable p-trap, polished chrome
	Supplies	½” x 3/8” polished chrome wheel handle stops with 3/8” o.d. chrome plated flex riser and escutcheon
	Mtd. Height	See architectural drawings
	Note	Furnish Handi-Lav-Guard Kit No. 101, p-trap insulation, cold water angle stop insulation and fasteners

P-4a	**Countertop Sink (Handicap)**	
	Note:	See Plumbing Fixture Schedules on Drawing P001.
	Drain	Grid strainer
	Trap	1-1/2” tubular adjustable p-trap, 17 gauge, polished chrome
	Supplies	Polished chrome ½” x 3/8” loose key angle stops with 3/8” o.d. flex risers
	Note	Furnish Handi-Lav Guard Kit No. 102, p-trap insulation, cold and hot water angle stop insulation and fasteners

P-4b	**Countertop Sink**	
	Note:	See Plumbing Fixture Schedules on Drawing P001.
	Drain	Grid strainer
	Trap	1-1/2” tubular adj.p-trap, 17 gauge, polished chrome
	Supplies	Polished chrome ½” x 3/8” loose key angle stops with 3/8” o.d. flex risers
	Note	Furnish Handi-Lav Guard Kit No. 102, p-trap insulation, cold and hot water angle stop insulation and fasteners

P-4c	**Wall Mounted Sink**	
	Note:	See Plumbing Fixture Schedules on Drawing P001.
	Drain	Grid strainer
	Trap	1-1/2” tubular adjustable p-trap, 17 gauge, polished chrome
	Supplies	Polished chrome ½” x 3/8” loose key angle stops with 3/8” o.d. flex risers

P-4d	**Wall Mounted Sink**	
	Note:	See Plumbing Fixture Schedules on Drawing P001.
	Drain	Grid strainer with lever handle
	Trap	1-1/2" tubular adjustable p-trap, 17 gauge, polished chrome
	Supplies	Direct connected

P-5a	**Electric Water Cooler High/low**	
	Note:	See Plumbing Fixture Schedules on Drawing P001.
	Supply	½" x 3/8" o.d. sweat angle stop
	Trap	1-1/4" x 1-1/2" 17 gauge tubular adjustable p-trap
	Carrier	Furnished with mounting bracket

P-5b	**Electric Water Cooler**	
	Note:	See Plumbing Fixture Schedules on Drawing P001.
	Supply	½" x 3/8" o.d. sweat angle stop
	Trap	1-1/4" x 1-1/2" 17 gauge tubular adjustable p-trap
	Carrier	Furnished with mounting bracket

P-6	**Service Sink**	
	Note:	See Plumbing Fixture Schedules on Drawing P001.
	Type	Floor mounted, precast terrazzo, 24" x 24", 3" strainer, stainless steel caps on all curbs
	Mfg	Fiat No. MSB 2424
	Faucet	Polished chrome, wall mounted pail hook, wall brace, vacuum breaker, integral stops
	Trap	3" cast iron p-trap
	Accessories	Hose and hose bracket Fiat No. 832-AA

P-7	**Hose Bibb**	
	Note:	See Plumbing Fixture Schedules on Drawing P001.
	Type	½" inlet, ½" outlet non-removable vacuum breaker, loose tee handle, wall mounted, brass construction, chrome plated
	Mfg	Woodford No. 24P

P-7a	**Wall Hydrant**	
	Note:	See Plumbing Fixture Schedules on Drawing P001.
	Type	¾" inlet, ¾" outlet, integral vacuum breaker, bronze casing and stainless steel face, operating key
	Mfg	Zurn Z-1310

P-7b	**Roof Hydrant**	
	Note:	See Plumbing Fixture Schedules on Drawing P001.
	Type	¾" inlet, ¾" outlet, integral vacuum breaker, stainless steel canister and galvanized riser, operating wheel handle

P-8	**Emergency Eyewash**	
	Note:	See Plumbing Fixture Schedules on Drawing P001.
	Mfg	Guardian, Bradley, Speakman, Stingray

P-8a	**Emergency Eyewash**	
	Note:	See Plumbing Fixture Schedules on Drawing P001.
	Mfg	Guardian, Bradley, Speakman

P-9	**Emergency Eyewash and Shower**	
	Note:	See Plumbing Fixture Schedules on Drawing P001.
	Type:	Wall mounted eyewash receptor with twin heads mounted in a recessed 16 gauge stainless steel cabinet. ½" stay open eyewash valve, 1" shower valve activated by a stainless steel pull bar, 10" diameter stainless steel shower head, 1" tempered water supply connection, 2" drain tailpiece.
	Mfg	Guardian, Bradley, Speakman

2.3 CLEANOUTS:

A. Cleanouts shall have cast iron body and screw type cleanout plug with lead seal. Cleanouts shall be manufactured by Wade, Zurn, J.R. Smith or Zurn, and shall be as follows:

1. Vinyl Floor Finish: Wade Services W-7000. Four (4) inch cast iron cleanout with adjustable housing, ferrule with plug and roundnickel brass secured top recessed for tile, vandalproof cover, spigot outlet.
2. Carpet Floor Finish: Wade Series W-7000. Four (4) inch cast iron cleanout with adjustable housing, ferrule with plug and round nickel brass scoriated top with carpet marker, spigot outlet.
3. Conc. Floor Finish: Wade Series W-7000. Four (4) inch cast iron cleanout with adjustable housing, ferrule with plug and round nickel brass scoriated top, vandalproof cover, spigot outlet.
4. Cleanout in Concealed Vertical Piping: Wade Series 8400. Cast iron cleanout tee with brass plug and round stainless steel vandal proof access cover, size as specified.

2.4 WATER HAMMER ARRESTERS:

A. Water Hammer Arresters: Provide piston O-ring type water hammer arresters, copper casing, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201, rated for sealed wall construction.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIXTURES:

A. Unless otherwise indicated, PC shall furnish and install all plumbing fixtures shown on drawings, including all necessary components and accessories.

B. All fixtures shall be properly connected to waste, vent and supplies in an absolutely rigid and substantial manner.

C. All fixtures shall be caulked to the wall or floor with a soft elastomeric caulking compound of color to match fixtures.

D. All flush valves, shower valves, shower heads, hose bibs, mixing faucets, and similar equipment normally held in place by the attached piping shall have the attached piping secured in the walls so that the item of equipment is held rigidly in place. At the time of final inspection, or during the warranty period, if any item can be moved with normal hand pressure, that item shall be re-secured in the wall.

E. All wall-hung fixtures shall be secured, rigidly in place. At the time of final inspection or during the warranty period, if fixtures can be moved by normal hand pressure, they shall be secured to the wall.

F. If the preceding two paragraphs required cutting of the wall to secure the items in place, cutting and patching shall be done by the trade that originally installed the wall surface, but the work shall be paid for by the plumbing subcontractor.

3.2 SUPPORTS AND CARRIERS:

A. Bolt to floor with 1/2" bolts and Philips #S-12 concrete anchors.

3.3 FLUSH VALVES:

A. Provide with Sloan YP copper kits.

3.4 INSTALLATION OF PIPING AND TRIM:

A. All piping through wall shall be grouted to wall with cement or plaster to assure rigidity and to prevent noise transmission to other rooms.

B. Provide chromium finished escutcheon plates on all piping passing through floor or wall. Escutcheon plates shall be held tight to wall with flush-head or socket type set screws.

C. Exposed bolt heads shall be covered with china or chrome plated caps.

3.5 INSTALLATION OF STOP VALVES:

A. Each water service connection to fixtures shall be individually valved.

B. Integral stops of flush valves or fixture fittings as specified will be considered as a stop valve.

3.6 INSTALLATION OF INDIVIDUAL SERVICE CONNECTIONS:

A. Individual service connection is defined as the short run of piping for water, waste and vent between the fixture and branch line or main.

B. Individual service connection to fixtures shall be of one pipe larger than the outlets provided on the fixtures and associated trim, or as indicated on drawings.

3.7 INSTALLATION OF FLUSH VALVES:

A. Flush valves for water closets shall be provided as specified under the plumbing fixtures paragraph and shall be of the quiet operating type with vacuum breaker and screwdriver stop. Provide caps to cover screwdriver stops. Flush valves shall be manufactured by Sloan. Valves as manufactured by Delany and meeting all requirements of this specification will be acceptable.

3.8 INSTALLATION OF BACKFLOW PREVENTERS:

A. Install backflow preventers where indicated, and where required by North Carolina Plumbing Code. Locate in same room as equipment being protected. Pipe relief outlet to nearest floor drain through air gap fitting.

3.9 INSTALLATION OF PRESSURE REGULATING VALVES:

A. Install pressure regulating valves where indicated. Provide inlet and outlet shutoff valves, and globe valve bypass. Provide pressure gage on valve outlet.

3.10 INSTALLATION OF CLEANOUTS:

A. Cleanouts in general must be screw plug which must be gas and watertight, provide quick and easy plug removal, located in such a manner to allow ample space for rodding tools.

B. Cleanout openings shall not be used for any other purpose than the proper cleaning of the system, except where approved in writing by the administrative authority.

C. Cleanout plugs shall not be covered with cement, plaster, or any other permanent finishing material. Where it is necessary to conceal a cleanout plug, a covering plate or access door shall be provided which will permit ready access to the plug.

D. Accessible cleanouts shall be installed at each change of direction of the building drain, or of horizontal waste or soil lines, which is greater than forty-five (45) degrees.

E. A cleanout shall be provided at or near the foot of each vertical waste or soil stack that serves more than one floor. Rain leaders and conductors connected to a building storm sewer shall have a cleanout installed at the base of each riser.

F. Cleanouts, when installed on underground piping shall be extended vertically to or above the finished grade level.

G. Cleanouts on concealed piping shall be extended through and terminate flush with the finished wall or floor, or pits or chases may be left in the wall or floor, provided they are of sufficient size to permit removal of the cleanout plug and proper cleaning of system.

H. Where sanitary crosses are installed in the system and are the type that would allow a cable (or cleaning equipment) to pass over the vertical waste and vent stack and into the adjoining fixture waste pipe and fixture trap, the Plumbing Contractor shall provide a wall cleanout above the sanitary cross which extends to the surface of the wall and is equipped with the proper cleanout cover.

I. Cleanouts shall be of the same nominal size as the pipes they serve up to four (4) inches and not less than four (4) inches for larger piping.

3.11 WATER HAMMER ARRESTORS:

A. Install water hammer arrestors on all fixtures and equipment with quick closing valves.

END OF SECTION 22 40 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The requirements of the 22 Series sections govern the work specified in this section.

1.2 DESCRIPTION OF WORK:

A. The extent of fuel gas piping work and its associated equipment is indicated by drawings and schedules, and by the requirements of this section. Fuel gas piping is defined to include piping for natural gas from the point of tie-in to the gas meter to the connection with each gas utilization device. Run 2 psi gas after the meter and provide regulators to step down the pressure at each piece of equipment.

B. The applications for fuel gas piping include connection to the following gas utilization appliances:

1. Welding Lab
2. Water Heaters
3. HVAC Equipment

1.3 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in the manufacture of gas piping products, of the quality and sizes required.

1.4 SUBMITTALS:

A. Product Data, Fuel Gas Piping and Equipment: Submit manufacturer's data on gas piping products and equipment.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with the 22-Series sections for product requirements of piping materials. For each service, provide the piping materials indicated including pipe, tube, fittings, hangers, supports, anchors, valves and accessories. Where more than one type is indicated, selection is Installer's option.

B. Materials:

1. Provide products complying with "National Fuel Gas Code," ANSI Z 223.1 (NFPA Standard No. 54), where type is not indicated.

2. Bushings, street ells and street tees are prohibited, use eccentric reducing fittings, burred ends shall be reamed to the full bore of the pipe.

C. Fuel Gas Piping:

1. Pipe size 2" and smaller: Black steel pipe of the size indicated.
2. Pipe Weight: Schedule 40.

3. Fittings:
   a. Class 150 malleable iron threaded.
   b. Forged steel threaded.
   c. Forged steel socket welding.
   d. Wrought steel buttwelding.
   e. Steel flanges and flanged fittings, Class 150.
   f. Tube Size 3” and Smaller:
   g. Copper tube of the size indicated.
   h. Wall Thickness:
   i. Type K
   j. Type L
4. Gas piping in concealed spaces shall be joined by one of the following methods per Section 404.5 of the 2015 International Fuel Gas Code:
   a. Threaded elbows, tees and couplings listed for concealed installation.
   b. Brazed fittings & joints.
   c. Welded fittings & joints.
   d. Fittings listed to ANSI LC-1 or ANSI LC-4.

2.2 FUEL GAS PIPING PRODUCTS:

A. Provide factory-fabricated piping product of the size and type indicated. Where not otherwise indicated, provide products as determined by the installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections.

B. Gas Pressure Regulators: This Contractor shall have gas regulator installed by operating gas supplier, and shall bear all cost for regulator and installation. Regulators shall be the ventless type.

C. Swing Check Valves: Provide steel swing check valves, with gas impervious disks, 150 psi rated WOG, and screwed ends.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SYSTEM:

A. Comply with the requirements of the 22-Series sections for installation of basic piping materials. Install piping products in accordance with the manufacturer's written instructions.

B. Applicable requirements of ANSI Z 223.1, and in accordance with recognized industry practices to insure that products serve the intended function.

C. Use sealants on metal as piping threads which are chemically resistant to natural gas. Use sealants sparingly and apply to only male threads of metal joints.

D. Remove cutting and threading burrs before assembling piping.

E. Do not install defective piping or fittings. Do not use pipe with threads which are chipped, stripped or damage.

F. Plug each gas outlet, including valves with a threaded plug or cap, immediately after installation, and retain until continuing piping or equipment connection is completed.

G. Ground gas piping electrically and continuously within project, and bond to grounding electrode.

H. Install drip-legs in gas piping where indicated or at end of each main and branch.

I. Install "Tee" fitting with bottom outlet plugged, or capped, at bottom of pipe risers.

J. This Contractor shall furnish and install gas cocks painted orange, so as to be easily accessible for operation. Install gas cock at each piece of equipment.

K. Use insulated couplings when dissimilar metals are jointed underground.

L. Outlet connections shall be from top of main.

M. Protection of Gas Piping Against Corrosion: Protect metal gas piping in contact with the earth, or other corrosive material, against corrosion. Seal wrap piping with coal-tar saturated wrapping tape over coal-tar epoxy coating (20 mils thick).

N. Coordinate with gas utility company as necessary to interface gas piping with existing gas service supply work.

3.2 EQUIPMENT CONNECTIONS:

A. Connect fuel gas piping to equipment in the manner shown, and comply with equipment manufacturer's instructions where not otherwise indicated.

3.3 FIELD QUALITY CONTROL:

A. Fuel Gas Piping Tightness Test: Prior to initial operation, test and purge fuel gas piping in accordance with ANSI Z 223.1 National Fuel Gas Code.

B. Repair to replace fuel gas piping as required to eliminate leaks, and retest as specified to demonstrate compliance.

END OF SECTION 22 63 13

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PART 1 - GENERAL

1.1 RECORD DRAWINGS - BUILDING:

A. Submit as-built drawings as required by General Conditions and obtain written receipt from engineer.

1.2 DEMONSTRATION OF COMPLETE PLUMBING SYSTEMS:

A. The following systems shall be put into operation by the plumbing sub-contractor furnishing the equipment, and operated for the length of time required to prove proper operation and control.

1. Cold Water
2. Hot water systems/recirculation systems
3. Waste
4. Storm
5. Lab Gases
6. Natural Gas Piping

B. Thoroughly demonstrate and instruct (3) three designated representatives of the Owner in the care and operation of all the plumbing systems and equipment furnished and installed in the contract.

C. Manufacturers of certain equipment specified herein shall provide technically qualified factory representatives to train the Owner's representative in the care and maintenance and operation of their product. This instruction and service of the factory representative shall be furnished as specified elsewhere in the specifications. This time is in addition to what is specified above and will not be counted as part of this contractor's instructions.

D. The time and place of all training shall be coordinated and scheduled by the contractor at the convenience of the Owner and as approved by the architect.

E. Submit letters signed by the owner's representatives attesting to the satisfactory completion of all instructions.

1.3 OWNER'S RIGHT TO TEST SYSTEM:

A. Should, in the opinion of the architect, and during the guarantee period, reasonable doubt exist as to the proper functioning of any equipment installed under this contract, the right is reserved for the owner and architect to perform any test deemed practical to determine whether such equipment is functioning properly and performing at required capacity. If such tests show proper functioning, the cost of the test will be paid by the owner. If the tests indicate a deficiency in equipment capacity or performance, the contractor shall pay the cost of the test and also make good any deficiencies shown by the test to the full satisfaction of the owner and the architect.

1.4 OPERATING AND MAINTENANCE MANUALS:

A. The contractor shall carefully prepare an operating instructions and maintenance manual for each plumbing system, including all equipment furnished. The manual shall be submitted to the engineer for approval before final inspection and acceptance is made.

B. The form in which the operating maintenance manual is to be presented shall be subject to approval by the architect. Three copies of the manual shall be provided.

C. The following items together with any other necessary and pertinent data shall be included in the manual. This list is not necessarily complete and is only to be used as a guide.

1. Suggested settings of all control and switches for normal operation with description of control and its location.
2. A check list for periodic maintenance of all equipment.
3. As-built wiring, interlock, and control diagrams for the equipment, with color coding shown on wiring and interlock diagrams.
4. Part numbers of all replaceable items.
5. Manufacturer's cuts and rating tables for all equipment.
6. Oiling, lubricating and greasing data.
7. Complete electrical load data from operation tests.
8. Test data on all equipment
9. Belt sizes, types, and lengths
10. Serial number of all principal pieces of equipment
11. Valve tag schedule
12. Manufacturers', suppliers' and contractors' names, addresses and telephone numbers.

1.5 VALVE TAG SCHEDULE:

A. Copies of the valve tag schedule and wiring diagrams shall be framed under glass and posted in the equipment room.

1.6 WARRANTIES:

A. Deliver to Owner all warranties, etc., and obtain written receipts.

1.7 OBSERVATION REPORTS:

A. During construction period the engineer will issue observation reports. These items shall be completed before engineer will approve next application for payment. Final punch list work shall be complete before acceptance.

1.8 FINAL INSPECTION AND ACCEPTANCE:

A. The architect or his authorized representative will entertain the request for final inspection and acceptance only after the following items are done.

1. Submit a list of uncompleted items, if any, and advise when the items will be done.

2. Clean, test, and adjust all systems and equipment.

3. Lubricate all motors.

4. Complete all items on architect's or engineer's pre-final punch list.

5. Final inspection and tests of the completed construction shall be performed in the presence of the architect or his representative and shall be at such times as are convenient to the architect. Final tests shall show conclusively that all equipment performs its intended and specified function and that all work complies with the provisions of these specifications. All material, equipment, and instruments required for these tests shall be furnished by the contractor at his own expense.

6. Final Clean-up. During construction the contractor shall keep the site clear of debris and upon completion of construction he shall clean up the premises to remove all evidence of his work. In addition, upon completion of construction he shall clean, wash, and/or polish all fixtures, equipment, and exposed material and leave them bright and clean.

END OF SECTION 22 90 00

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PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. The work to be done under Division 23 contract shall include the furnishing of all labor, materials, equipment, and services necessary for and reasonably incidental to the proper completion of all work as shown on the plans and herein specified, excepting only work materials specified or noted as being furnished or installed by others.

B. All work shown in the drawings and specifications shall be included under the base bid, except where there is specific reference to exclusion and incorporation in other quotation.

C. The HVAC Contractor may hereinafter also be referred to as "This Contractor", “Mechanical Contractor”, "MC", or “Division 23 Contractor”.

D. Drawings shall not be scaled. Refer to architectural and structural drawings for building construction and dimensions and to room finish schedule or architectural drawings for material, finish and construction method of walls, floor and ceiling in order to insure proper rough-in and installation of work.

1.2 WORK INCLUDED:

A. The HVAC Contractor shall be responsible for including all labor, accessories, tools, equipment and material required to completely execute installation of the entire heating, ventilating and air conditioning system as shown on the drawings and as specified. Work under the Mechanical contract shall include but not be limited to the furnishing, unloading, handling distribution, setting and installation of all components required for the following systems:

1. Air Conditioning System
2. Heating System
3. Ventilation System
4. Air Distribution System
5. Insulation
6. Temperature Control
7. Testing and Balancing
8. Condenser Water System
9. Hot Water System
10. Condensate Drain System
11. Other Work as Herein Specified

1.3 RELATED WORK WHICH IS A PART OF SECTION 23 01 00:

A. All work done under this section of the specification is subject to the Architect's instructions to bidders, general conditions and their corresponding supplements, and acoustic supplement specification sections.

B. Refer to the supplementary general conditions of these specifications for temporary services and facilities that shall be provided.

1.4 DEFINITIONS:

A. "Piping": Pipe, fittings, flanges, valves, controls, hangers, traps, drains, insulation, vents, and items customarily required in connection with the transfer of fluids.

B. "Ductwork": All air delivery, recirculation and exhaust ducts, whether of sheet metal or other material, and includes all connections, accessories, and appurtenances necessary for and incidental to a complete system.

C. "Provide" (P): Furnish and install complete ready for use.

D. "Furnish" (F): Purchase and deliver to the project site complete with every necessary appurtenance and support.

E. "Install"(I): Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation of the proper location in the project.

F. "Concealed": Embedded in masonry or other construction, installed behind wall furring, within double partitions of hung ceilings, in crawl spaces, in shafts.

G. "By Other Trades": Shall mean by persons or parties who are not anticipated to be the HVAC Contractor working together with the general contractor. In this context the words "by other trades" shall not be interpreted to mean not included in the overall contract.

1.5 ABBREVIATIONS:

AD	Automatic Damper (Motor Operated)/Access Door
AFF	Above Finish Floor
AMP	Amperes
AP	Access Panel
AV	Air Vent
BO	By Others
BOW	Baked On White
CC	Cooling Coil
CD	Ceiling Diffuser
CHWR	Chilled Water Return
CHWS	Chilled Water Supply
CL	Ceiling
CONTR	Contractor
CP	Circulating Pump
CS	Condenser Water Supply
CR	Condenser Water Return
DB	Decibels
DIS.SW	Disconnect Switch
DN	Down
EA	Exhaust Air
EF	Exhaust Fan
ELEC	Electrical
E/S	Emergency Stop Switch
F	Furnish or Filter
FD	Floor Drain/Fire Damper
FL	Floor
G	Grille
HC	Heating Coil
I	**Install**

NC	Noise Criteria
OBD	Opposed Blade Damper
P	Provided (Furnished & Installed)
PH	Phase
PLBG	Plumbing
PRV	Pressure Reducing Valve
RA	Return Air
RF	Return Fan
SA	Supply Air
SD	Strip Diffuser
SF	Supply Fan
SP	Static Pressure
T	Transfer/Thermostat
UG	Underground
UH	Unit Heater
VAV	Variable Air Volume
Ø or PH	Current Phase

1.6 INTERPRETATION OF CONTRACT DOCUMENTS:

A. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any item, in the drawings or specifications or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.

B. It shall be understood that the specifications and drawings are complementary and are to be taken together for a complete interpretation of the work. Exceptions are that notes on the drawings, which refer to a specific element of work, take precedence over the specifications where they may conflict.

C. No exclusions from, or limitations in, the language used in the drawings or specifications shall be interpreted as meaning that the appurtenances or accessories necessary to complete any required system or item of equipment are to be omitted.

D. The drawings of necessity utilize symbols as schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed in accordance with the diagrammatic intent expressed on the drawings, and in conformity with the dimensions indicated on final architectural and structural working drawings and on equipment shop drawings.

E. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded.

F. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the intended work.

G. Information as to the general construction shall be derived from structural and architectural drawings and specification only.

H. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.

1.7 DELINEATION OF WORK:

A. The HVAC contractor is required to supply all necessary supervision and coordination of information to any others who are performing work to accommodate HVAC installations. Where the mechanical contractor is required to install items which he does not purchase, he shall include for such items:

1. The coordination of their delivery.

2. Their unloading from delivery trucks driven in to any designated point on the property line.

3. Their safe handling and field storage up to the time of permanent placement in the project.

4. The correction of any damage, defacement or corrosion to which they may have been subjected.

5. Their field assembly and internal connections as may be necessary for their proper operation.

6. Their mounting in place including the purchase and installation of all dunnage supporting members and fastenings necessary to adapt them to architectural and structural conditions.

7. Their connection to building systems including the purchase and installation of all terminating fittings necessary to adapt and connect them to the building systems.

B. Items which are to be installed but not purchased as part of the work of the HVAC contractor shall be carefully examined upon delivery to the project. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of the work will be considered only if presented in writing within one week of the date of delivery to the project of the items in question. The work under this contract shall include all procedures, regardless of how extensive, necessary to put into satisfactory operation, all items for which no claims have been submitted as outlined above.

C. The specifications for the overall construction delineate various items of work under separate section headings. The list below set forth this delineation to the extent that it affects the HVAC work category. In the absence of more detailed information, this list shall be taken as a specific instruction to the HVAC contractor to include the work assigned to him. Indications that each contractor is to perform the work means that it is to perform the work for its own accommodation only, except as specifically noted otherwise.

D. This HVAC contractor is required to supply all necessary supervision and coordination of information to any others who are supplying work to accommodate his installation.

"P" indicates Provide "F" indicates Furnish "I" indicates Install			
Item	"General"	"Plbg"	"HVAC"
Motors for mechanical equipment	_____	_____	P

"P" indicates Provide "F" indicates Furnish "I" indicates Install			
Item	"General"	"Plbg"	"HVAC"
Motor controls for mechanical equipment			P
Power wiring for mechanical equipment	Refer to Electrical Sections		
Hoisting			P
Rigging			P
Cutting and patching			P
EXCEPTION: Cost where due to late installation or improper coordination of work is the responsibility of the delinquent contractor. Locations shall be approved by structural engineer.			
Framed slots and openings in walls, decks and slabs	P		
EXCEPTION: Coordination drawings are required from HVAC contractor.			
Sleeves through non-membraned slabs, decks and walls			P
Sleeves through membraned slabs, decks and walls			P
Fireproof sealing of excess opening in slabs, decks and fire rate walls			P
Excavation and backfill of trenches			P
EXCEPTION: Drawings delineate exceptions.			
Keeping trench excavations free from water during construction			P
EXCEPTION: The general contractor shall be responsible for keeping the entire site free of surface water.			
Fastenings			P
Supports			P
Concrete foundations, pads & bases			P
Field touch-up painting damaged shop coats			P

"P" indicates Provide "F" indicates Furnish "I" indicates Install			
Item	"General"	"Plbg"	"HVAC"
Finish painting of exposed work and work on roof	P		
EXCEPTION: Painting of equipment, piping, etc. in mechanical spaces provided by HVAC contractor. The HVAC contractor shall prime all exposed ductwork, piping, etc. in finished spaces and equipment on roof.			
Exterior wall louvers	P		
EXCEPTION: Drawings and specifications delineate exceptions.			
Finished wall and ceiling access doors, panels and support frames	I		F
EXCEPTION: HVAC contractor shall furnish and locate all required access doors to the installing trade. (Refer to Architectural specifications for type.)			
Removal of spray on fire proofing from mechanical equipment, ductwork, hangers etc.	P		
Rubbish removal			P
EXCEPTION: Where one trade furnishes and another installs, the installing trade shall remove the shipping and packing material which accumulate.			
Special tools for equipment maintenance			P
Piping and associated work outside of the building line			P

1.8 STANDARDS AND CODES:

A. Nothing in this specification shall be interpreted to conflict with any State law, regulation, code, ordinance, ruling or Fire Underwriters requirement applicable to this class of work.

B. All installations for construction purposes shall conform with the Department of Labor "Safety and Health Regulations for Construction."

C. All equipment with electrical components shall bear the UL label, or be certified by an independent laboratory approved by SC OSE.

D. The following minimum standards apply wherever applicable:

ANS American National Standards
ASME American Society of Mechanical Engineers
ASTM American Society for Testing Materials
NEMA National Electrical Manufacturers Association
NFPA National Fire Protection Association

OSHA	Occupational Safety and Health Act
SMACNA	Sheet Metal and Air Conditioning Contractors National Assoc., Incorporated
AGA	American Gas Association
ASA	American Standards Association
NBFU	National Board of Fire Underwriters
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning, Engineers, Inc.

1.9 INSPECTION AND COOPERATION:

A. All work shall be done under the periodic observation of and to the complete satisfaction of the Architect. No deviations from the Drawings and Specifications will be allowed without prior written approval of the Architect.

B. The HVAC contractor shall cooperate with the other contractors to allow for the installation of their work as well as his own.

C. The HVAC contractor shall be responsible for his work fitting in place without conflict with the other trades, where proper planning could avoid interference. Any work installed by this contractor without regard for other work, or if a conflict results, must be changed if directed by the Architect or Engineer without additional cost to Owner or his agents.

D. Relocation of equipment, ductwork, piping, system connections or rough-in locations up to ten feet (10') in any direction, if necessary, shall be done at no additional cost to the Owner or his agents upon notification, or as determined by the preparation of fabrication or coordinated shop drawings, prior to installation.

E. All concealed work shall be inspected by the Architect or his appointed representative before being concealed. HVAC contractor shall call for inspection at least two (2) work days before concealment.

F. The Architect shall have the right to inspect the work whenever advisable in his judgment. The HVAC contractor shall have a representative present at each inspection and shall give such assistance as may be required.

G. Recommendations made by the Architect shall be promptly carried out and all unsatisfactory material and workmanship replaced at once to the Architect's satisfaction at the HVAC contractor's expense.

H. HVAC contractor shall be responsible for hoisting of all materials and equipment furnished under as part of his portion of the work in accordance with all State and Federal rules and regulations.

1.10 TEMPORARY SERVICES AND FACILITIES:

A. Refer to general requirements for temporary services and facilities that shall be provided.

1.11 UNIT PRICES:

A. Refer to general requirements relative to "Add" or "Deduct" prices relative to this contract.

1.12 SUBMITTALS:

A. LIST OF MANUFACTURERS: Within twenty days following award of contract, the HVAC contractor shall submit the required information pertaining to the equipment and materials

he will be furnishing, commencing with the list of manufacturers for approval by the Engineer. Following up in short order shall be the shop drawings and other documents. The Owner and his representatives reserve the right to reject as unacceptable any items for which, in their judgment, they have not been allowed adequate lead time in which to investigate suitability, or their experience has proved the service or equipment unsatisfactory.

B. SHOP DRAWINGS:

1. Prior to purchasing any equipment or materials, the approved list of the manufacturers shall be returned by the Engineer to the HVAC contractor.
2. Shop drawings shall be submitted conforming to the requirements stated in supplementary conditions and Division 01 for the items indicated throughout the following specifications:
3. Documents will not be accepted for approval unless:

    a. They comply with the requirements of the supplement to the General Conditions
    b. They include complete information pertaining to appurtenances and accessories.
    c. They are submitted as a package where they pertain to related items.
    d. They are properly marked with service or function identification as related to the project, where they consist of catalog sheets displaying other items which are not applicable, and are marked with pertinent specification paragraph number.
    e. They are properly marked with external connection identification as related to the project where they consist of standard factory assembly or field installation drawings.
    f. The submittal is stamped approved by the HVAC contractor and contain no other markings.

4. Approval of shop drawings does not invalidate the plans and specifications if in conflict, unless a letter requesting such change is submitted and approved on the Engineer's letterhead.

1.13 FABRICATION DRAWINGS:

A. Prior to assembling or installing the work, the following shall be submitted to the Architect by the HVAC contractor:

1. Scaled drawings indicating insert and sleeve locations. The background shall include the structural framing plan.

2. Scaled CADD drawings (1/4" or larger) showing dimensional locations in plan and elevation of all piping, cable tray, conduit, sprinkler systems, ductwork and equipment. Supervisor or foreman of the Fire Protection, Plumbing, Mechanical and Electrical installing trade shall review drawings for coordination and initial as a sign of approval, each drawing he reviews.

3. Scaled CADD drawings (1/4" or larger) showing dimensional locations in plan and elevation of all piping, ductwork and equipment in equipment rooms.

B. The following general rules shall apply to the proceeding items:

1. The sprinkler piping will generally be run dead level, without pockets, so the piping system is drainable. The HVAC contractor shall be furnished copies of a "CADD" disc and the Fire Protection shop drawings for use in preparing the coordinated duct drawings.

2. Storm drain piping and sanitary waste piping, in which the grade must be maintained, shall have first priority. Ducts and other pipes shall be offset to avoid them.

3. Service piping (water, gas, air, ultrapure water, etc.) shall generally be run below ductwork so they will be accessible for service and modifications. The pipes will be offset as required to avoid interfering with access to duct access panels, dampers, etc.

4. The HVAC contractor shall be furnished copies of a "CADD" disc of the plumbing piping layout.

5. Ducts will have next priority. Ducts will be offset as required to avoid pipes and cable trays.

6. Where pipes of different trades conflict, such as domestic water vs. chilled water, the smaller pipe shall be offset.

1.14 AS-BUILT DRAWINGS:

A. The HVAC contractor shall provide one set of updated coordination mechanical plansand set of CADD discs to the Engineer for his preparation of close out documents. The updated plans shall indicate correct location of all equipment, piping, etc. as installed on project.

B. The drawings shall provide an accurate and complete record of the work as installed, and shall be presented at each monthly meeting for review by the architect.

1.15 RECORD DRAWINGS:

A. Purchase and maintain at the job site a complete and separate black line set of prints of the approved working Drawings on which to accurately indicate daily progress by coloring materials and apparatus as installed. Schedules shall be modified to reflect data consistent with that of the installed equipment. Clearly show all changes to work as a result of change orders, instruction issued by the Architect or conditions encountered in the field. Accurately indicate the locations, size, type and elevation of new utilities and their relationship to existing utilities.

B. The marked-up and colored-in prints will be used as a guide for determining the progress of the work installed. They shall be inspected at the architect's or construction manager's discretion and shall be corrected immediately if found inaccurate or incomplete. Requisitions for payment may not be approved until the drawings are accurate and up-to-date.

C. The mechanical contractor shall provide one set of marked plans to the Engineer for his review and approval of record drawings. The approved plans shall be returned to the contractor for his preparation of documents using AutoCAD version 14 or later to indicate correct location of all equipment, piping, etc. as installed on project.

D. The drawings shall provide an accurate and complete record of the work as installed.

1.16 UTILITY INSTALLATION COSTS:

A. All required auxiliary devices shall be provided by the HVAC contractor. All associated costs billed by the Utility Departments shall be included in this contract.

PART 2 - PRODUCTS

2.1 MATERIALS AND MANUFACTURERS:

A. All materials used in this work shall be new unless otherwise noted. All materials used on this project shall be listed and labeled by one of the third party agencies which have been approved by the North Carolina Building Code Council to safety test and label electrical and mechanical equipment. Any material installed that is not labeled shall be subject to a field evaluation by one of these approved agencies, at the contractor's expense, if requested by the authority having jurisdiction or the engineer. Any item not approved by the agency shall be replaced by the contractor at his expense. It shall be the contractor's responsibility to verify that materials specified or used on the project are labeled.

B. Each major component of equipment shall have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable. ASME Code ratings, UL label, or other data which is die-stamped into the surface of the equipment shall be stamped in a location easily visible. It is the intent of the specifications that wherever manufacturers of a product are specified any substituted item must conform in all respects to the specified item. Consideration will not be given to claims that the substituted item meets the performance requirements with lesser construction such as lesser heat exchange surface, etc.). Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance. In many cases equipment is oversized to allow for pick-up loads which cannot be delineated under the minimum performance.

C. Substituted equipment where permitted or approved, must conform to space requirements, whether approved or not or shall be replaced at the HVAC contractor's expense. Any modification of related systems as a result of substitutions shall be made at the HVAC contractor's expense.

D. Note the approval of shop drawings, or other information submitted in accordance with the requirements hereinbefore specified, does not assure that the Engineer, Architect, or any other Owner's Representative, attests to the dimensional accuracy or the ability of the material or equipment involved or the mechanical performance of the equipment.

2.2 SUBSTITUTION OF SPECIFIED MATERIALS:

A. It is the purpose of this specification not to exclude competition between manufacturers of similar equipment.

B. Where items are specified as "or approved equivalent" prior approval must be obtained from the Engineer. Said approval does not intend to obligate the Engineer in the event shop drawings submitted do not indicate equality of materials, workmanship or function and the right to reject substitutes shall remain the prerogative of the Engineer.

C. In all cases regardless of method of submission, the HVAC contractor shall be completely responsible for changes in dimension of other than first named manufacturer equipment, electrical changes, etc. required for proper function and final performance.

Item shall comply with all requirements herein set forth and as required to perform as designed. Minor modifications to suit standard manufactured items are acceptable if approved by Engineer.

D. Should contract documents fail to describe particular materials or goods to be used, then it shall be the duty of HVAC contractor to inquire of Engineer as to what is to be used and to supply it at HVAC contractor's expense.

E. HVAC contractor shall promptly remove, at own expense, rejected materials from site of work.

F. When material has been approved, no change in brand or make will be permitted without approval of Engineer.

2.3 NAMEPLATES:

A. All items of operation equipment used on the project shall be provided with a nameplate mounted in a conspicuous place on the unit. Plate shall be embossed metal or stamped metal securely fastened to the unit.

B. The plate shall contain the following information:

1. Manufacturer's name and address.
2. All approval stamps, AGA, UL, Etc. as hereinafter specified.
3. Complete capacity and operating data as approved by Engineer
4. Motor Characteristics
5. Serial number and code numbers
6. Date of manufacturer

2.4 V-BELT DRIVES:

A. Shall be rated for not less than 150 percent of the motor nameplate horsepower. Motor sheaves for motors 50 hp and under shall be adjustable to provide a plus or minus 20 percent speed variation from designed operating rpm. All V-belt drives on motors over 1/2 hp shall have a minimum of 2 belts. Belt drives shall be isolated by an approved expanded metal belt guard or by enclosing within the unit housing. Where belt guards are used, they shall be fabricated so as to allow a plus or minus 6 " variation in center line distances between driver and driven shafts. Access to ends of shafts shall be provided to allow for rpm readings. Fixed sheaves shall be provided on all motors over 50 hp with allowance for 1 change of sheaves.

2.5 APPROVED MANUFACTURER'S LIST:

SECTION	ITEM	MANUFACTURERS			
230513	Motors	Westinghouse	Wagner	Century	GE
230519	Thermometers	Weksler	Palmer	Trerice	Ashcroft
230519	Gauges	Ashcroft	Palmer	Trerice	Weksler
230523	Valves	Hammond	Nibco	Fairbanks	Stockham
230523	Circuit Setters	B&G	Taco	Armstrong	
230529	Vibration Isolation Hangers	Kinetics Noise Control	Mason Industries	EFI Concepts	
230548	Seismic and Vibration Isolations	Kinetics Noise Control	Mason Industries	EFI Concepts	Anvil
230700	Insulation	Knauf	Owens-Corning	Armstrong	John Mansville

SECTION	ITEM	MANUFACTURERS			
230900	Controls	Siemen's. Provided by Control Management Inc.			
230920	Variable Frequency Drives	ABB	Danfoss	Yaskawa	
232113	Pipe	Wheatland Tube	Allied Tube	Northwest Pipe	
232113	Fittings	Tube-Turn	Grinnel	Weldbend	Cerro Tube
232115	Sleeves	Pipe Shields	R&S Mfg	Clow	
233200	Sound Attenuators	Kinetics Noise Control	Ruskin	EFI Concepts	
233300	Dampers – All	Nailor Industries	Ruskin	Greenheck	
233413	Make Up Air Unit	Captive Aire	Greenheck	Cook	
233413	Exhaust Fans	Greenheck	Acme	Cook	Penn Barry
233423	Fans	Loren Cook	Penn Barry	Greenheck	Acme
233600	Air Terminal Units	Krueger	Trane	Nailor	
233713	Air Distribution Devices	Metal-Aire	Price	Titus	Nailor
236850	Split System	Mitsubishi	Trane	LG	Daikan
237070	Rooftop Units	Trane	JCI	Carrier	
238238	Unit Heaters	Trane	Markel	Chromolox	Electromode
238238	Electric Unit Heaters	Berko	Indeeco	Trane	
238240	Electric Wall Heaters	Berko	Indeeco	Trane	

PART 3 - EXECUTION

3.1 WORKMANSHIP:

A. Workmanship shall be of best quality. Good appearance of finished work shall be of equal importance with its mechanical efficiency. No make-shifts shall be permitted anywhere in work and all portions of work shall be so laid out and installed that work as a whole is of uniform quality and appearance.

3.2 PROTECTION OF EQUIPMENT:

A. Protect all materials and equipment from damage during storage at the site and throughout the construction period.

B. Protection from damage from rain, dirt, sun and ground water shall be accomplished by storing the equipment on elevated supports and covering them on all sides with protective rigid or flexible water proof coverings securely fastened.

C. Piping and ductwork shall be protected by storing it on elevated supports and capping the ends with suitable material to prevent dirt accumulation in the piping and ductwork.

D. This HVAC contractor shall be responsible for the work damaged by him in executing his contract. Any work damaged by the HVAC contractor shall be replaced by him and placed in perfect condition without extra cost.

3.3 CONTIGUOUS WORK:

A. If any part of the HVAC contractor's work is dependent for its proper execution or for its subsequent efficiency or appearance on the character or conditions of contiguous work not executed by him, the contractor shall examine and measure such contiguous work and report to the Architect in writing any imperfection therein, or conditions that render it unsuitable for the reception of this work. Should the HVAC contractor proceed without making such written report, he shall be held to have accepted such work and the existing conditions.

3.4 CERTIFICATES OF INSPECTION AND APPROVAL:

A. Upon completion of work, HVAC contractor shall furnish to the Owner certificates of inspection or approval from the authorities having jurisdiction if certificates of inspection or approval are required by law or regulation.

3.5 SLEEVES AND OPENINGS:

A. All sleeves and openings required shall be located and provided by the HVAC contractor for his portion of the work. Core drilling for missed sleeves shall be provided by the delinquent contractor.

B. In order to minimize liquid leakage or transfer of air between floors, it is the intent that pipe penetrations of floors (except in plumbing chases) be held to a minimum. Where it is necessary to penetrate floors, the pipe shall pass through sleeves set in the concrete, and the space between the pipe and sleeve shall be caulked to make it air tight.

3.6 ACCESS TO EQUIPMENT AND VALVES:

A. All control devices, specialties, valves and removable panels on equipment shall be so located as to provide easy access for inspection and maintenance, including removal of any interior components.

B. Should any work, such as piping, ducts, conduit, etc. be installed without due regard to the accessibility of devices installed by other contractors, the installation shall be relocated, offset or rerouted without cost to the Owner.

C. Where devices are to be concealed in walls or above nonremovable ceilings, the HVAC contractor shall furnish the required access panels to the GC for installation for their respective equipment.

D. Size of panels shall be 12" x 12" square for all wall panels and 24" x 24" for ceiling panels.

3.7 COORDINATION:

A. The HVAC contractor is cautioned that portions of the building have an unusually high quantity of piping, ducts, conduits, and other mechanical equipment, and space is limited. The HVAC contractor shall offset pipes as required to avoid interference at no additional cost to the Owner. Generally pipes in which grade must be maintained, such as waste and storm drain piping, and sprinkler piping, shall have first priority. Other pipes shall be offset as required to avoid those items. The HVAC contractor will be required to prepare coordinated shop drawings. The Plumbing Contractor will be furnished copies of these drawings and shall use them in determining pipe routing.

B. The HVAC contractor will make the basic duct drawings and send copies to the plumbing and electrical contractors. Within 30 days after receiving the copies, the contractors shall return them to the HVAC contractor, marked to show how plumbing pipes, conduits, etc, cross the ducts, and with suggested routing of pipe and conduit, etc. elevation for each. The HVAC contractor will use this information plus similar information received from other contractors to prepare the finished coordination drawings.

C. The HVAC contractor shall provide manufacturers installation drawings as shipped with equipment, field working and location drawings, coordination drawings, wiring diagrams as required to show information required for information and coordination of the work for other trades. This includes locations of equipment, sleeves, foundations, curbs, pipe connections, wiring connections, etc. These drawings shall be provided in advance of work in the area so that the necessary coordination can be done at the proper time. The drawings shall be submitted to the A/E for record only, and other contractors involved in the work for coordination.

D. The HVAC contractor shall coordinate the work of his trade and other trades in order that interference between fire protection, plumbing, mechanical, electrical, architectural and structural work will be avoided. Piping, ducts, conduits, etc. shall be kept as close as possible to ceiling, walls, columns, etc. in order to take up the minimum amount of space; and all offsets, fittings, etc. required shall be furnished without additional cost to the Owner. In case interferences develop, the Engineer will decide which equipment shall be relocated regardless of which was first installed.

E. Minor changes required by Owner, and any incidental changes required to meet structural conditions or to match trim etc. shall be made by this contractor without extra cost to the Owner. Generally, all pipes, and conduits except those in the equipment room and in other locations specifically designated on the plans shall be run concealed in furrings and chases. In the event that it is necessary to expose these items in finished areas, this shall be called to the Architect's attention before proceeding with the work.

F. The HVAC contractor shall cooperate closely with the General Contractor and all other contractors on the job in order that the job will progress smoothly to its completion. He shall lay out his pipe in advance of pouring floors, or installing walls, shall provide to the General Contractor the location and size of any openings he may require, and shall furnish for the installation by the General Contractor any sleeves, forms, inserts, or hangers required for his work. In the event of failure to do these things at the proper time, or improper location of the required items, the cutting and patching required to rectify the errors shall be done by the HVAC contractor who installed the original material being cut but shall be paid by the contractor at fault, as determined by the Engineer, at no additional cost to the Owner.

G. All equipment shall be installed with sufficient access and clearance for maintenance, repairs, and replacement. In the event that it appears necessary to install equipment without proper access or clearance, the work shall be stopped until written permission is received from the Engineer to install the equipment. Pipes shall be installed in such a way as to allow maximum headroom where pipes are in occupied areas. Valves shall be located in such a position that they are easily accessible and so that the valve wheels can be easily turned to full open or full closed positions.

3.8 CHASES, CUTTING AND PATCHING:

A. In new construction, chases in walls for any work to be installed by these HVAC contractor will be provided by the general contractor provided full information as to the

location and size of such chases and the necessary frames for openings is given to him by this contractor in such time as to cause no delay in the general contractor's work.

B. If this contractor should neglect to furnish the required information and by reason of his neglect chases and openings are not provided, the HVAC contractor shall, at his own expense, cut the required chases and openings and make such repairs as shall be necessary to restore the work to its original finish.

C. The cutting of chases, openings, or holes in floors and ceilings shall be done in a manner as not to endanger the stability of the structure or any part thereof. The HVAC contractor shall not in any case cut or alter the work of any other contractor without the approval and under the direction of the Architect or Engineer. All repairs resulting from cutting shall be under the supervision of the Superintendent of the General Contractor.

3.9 DISCREPANCIES:

A. In the event of discrepancy, immediately notify the architect for clarification and resolution.

B. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.10 JOB CONDITIONS:

A. Safety: Observe all required safety regulations and the manufacturer's warnings and instructions during the storage, handling and application of materials.

B. Necessary precautions shall be taken to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion or other harm.

C. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at the end of each day's work, in accordance with all applicable federal, state and local codes.

END OF SECTION 23 01 00

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PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. This section delineates the DIVISION OF WORK between Division 23 and Division 26.

B. Specific work to be done under Division 26 is hereinafter listed or described. All other work necessary for the operation of Division 23 equipment shall be performed under Division 23.

1.2 DIVISION OF WORK:

A. All individual motor starters for mechanical equipment shall be furnished and installed under Division 23 unless indicated as a part of a motor control center or designated "motor control trough". Motor starters provided in motor control centers and at motor control troughs shall be furnished under Division 26.

B. Under Division 26, power wiring rough-in shall be provided from junction box, trough, starter or disconnect switch, as required by the specific piece of equipment. Equipment final connections shall be provided under Division 26.

C. Duct smoke detectors shall be furnished by Division 26, installed by Division 23, and wired under Division 26. Fire alarm fan shut-down contacts will be provided by Division 26 at the fire alarm control panel or adjacent to smoke detector, for the equipment involved. Extension and wiring of same will be by Division 23 control sub-contractor and shall be closely coordinated between trades.

D. All relays, actuators, timers, alternators, pressure sensors, float, flow switches, pneumatic-electric, and electric-pneumatic switches, aquastats, freezestats, line and low voltage thermostats, thermals, remote selector switches, remote push-button stations, emergency break-glass stations, interlocking, disconnect switches beyond termination point, and other appurtenances associated with equipment under Division 23 shall be furnished, installed and wired under Division 23.

E. All wiring required for controls and instrumentation not indicated on the drawings shall be furnished and installed by Division 23.

F. The sequence of control for all equipment shall be as indicated on the Division 23 drawings and specified under Division 23.

G. Additional power wiring required for HVAC equipment over and above what the electrical contractor is required to provide in accordance with the electrical drawings shall be provided by the HVAC contractor.

END OF SECTION 23 01 04

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PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Provide all concrete and masonry work as indicated on the heating and cooling and ventilating contract drawings, unless it is indicated that it will be by the general contractor. This includes bases for equipment.

PART 2 - PRODUCTS

2.1 GENERAL

A. All cement, gravel, sand, reinforcing rod, brick, block and other materials comply with the requirements for those materials in the specifications for the general contractor.

PART 3 - EXECUTION

3.1 GENERAL

A. The workmanship and manner of placing the materials shall comply with the requirements for those items in the specifications for the general contract.

B. Bases shall have smooth tops and cambered edges.

END OF SECTION 23 02 10

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PART 1 - GENERAL:

1.1 COORDINATION:

A. The HVAC contractor shall coordinate with the other contractors as required to produce workable, controllable systems. Generally, all controls and equipment shall be furnished and installed by this contractor unless otherwise noted. Specific examples of coordination and cooperation include:

B. All wiring between sensors and controlling devices shall be provided in accordance with the motor control schedule.

1.2 SCOPE OF WORK:

A. This work shall consist of furnishing all labor, material, equipment, and services necessary for the installation of all equipment specified hereinafter.

B. Equipment and components principally relevant to this section include:

1. Motors
2. Controllers and Controls
3. Other items where shown on the drawings or as specified.

PART 2 - PRODUCTS:

2.1 MOTORS:

A. Unless otherwise specified, all electrical motors provided shall be single phase, capacitor start-induction run, listed volt, 60 cycle, open type, splashproof up to 1/2 HP, and shall have ball or sleeve bearings. Motors 3/4 HP and larger shall be open, splashproof, listed voltage, 3 phase, induction and shall have ball bearings, same type as above unless otherwise specified. All exterior motors shall be totally enclosed, waterproof type. All motors shall be 40C ambient, NEMA standard, continuous duty as manufactured by Wagner, General Electric, Westinghouse or Century. All vertically mounted motors shall be provided with thrust bearing. Each motor horsepower scheduled or specified is the minimum acceptable and shall have a nameplate rating of not less than 10% above brake horsepower. If horsepower or KW ratings are increased, HVAC contractor who supplies equipment will be responsible for increase in motor starter size, wiring and circuit breaker in panel.

B. All motors over 1 horsepower shall be Gould Century energy efficient "E plus" motors or approved equal. Motors drawing over 1000 watts at full load shall have a power factor of not less than .85 and the power factor times efficiency product shall not be less than the following:

HP	PF x EFF (%)	HP	PF X EFF (%)
		20	80.1
		25	81.5
1	68.4	30	79.7
1-1/2	71.8	40	81.0
2	73.3	50	81.2
3	73.4	75	82
5	76.0	100	82
7-1/2	77.3		
10	77.4		
15	78.8		

C. Motors that are specified to cycle on and off automatically under control of a device shall be capable of making starts as frequently as the device may demand. Other motors shall be capable of being started four times per hour without damage.

2.2 CONTROLLERS AND CONTROLS:

A. All starters shall be provided under Division 23 unless located in a motor control center in which case they will be provided under Division 26. Refer to electrical drawings for location of starters. Where controllers and controls are specified to be provided they shall conform to the requirements specified below.

B. Controllers shall conform to adopted standards and recommended practices of the Industrial Control Standards of the National Electrical Manufacturers Association and the standard for Industrial Control Equipment of the Underwriters Laboratories, Inc. Motors 1/8 horsepower or larger shall be provided with thermal overload protection. Overload protective device shall be provided, mounted in separate enclosure, manually reset type. Single or double-pole tumbler switches may be used as manual controllers for motors of 1/4 horsepower shall be designed for purpose and shall have horsepower rating adequate for motor.

C. Magnetic starters shall be full voltage, across the line type with under-voltage release for manual or automatic operation and shall break all phases on 3 phase starters. Starters shall be provided with start-stop pushbuttons mounted on cover unless controlled by hand-off-automatic device. Hand-off-automatic device shall not be wired to override safety device interlocks on starter mounted on or adjacent to starter except where indicated on Plans. If selector is mounted remotely, provide test start pushbutton on starter. All auxiliary contacts required for interlocking purposes shall be furnished and installed by HVAC contractor.

D. Manual starters shall be provided with a manually operated trip-free switch, horsepower rated with a separate fused disconnect.

E. HVAC Contractor who furnishes starters shall be responsible that all motors are protected with proper size heater on thermal elements and fusetrons. Fuses shall be dual element type, sized not over 25% above nameplate FLA. All starters and enclosures shall be NEMA Standard, Type l unless otherwise specified.

F. All starters and pushbutton stations shall be provided with labels as specified under identification designating service for which starter is used. Plate shall be firmly attached to starter or wall mounted adjacent to starter.

G. All cabinets provided for the installation of motor starters, control transformers, relays and appurtenant items shall be provided with gravity or forced ventilation at the option of the manufacturer. Opening shall be placed at bottom and top of the cabinet or high-low in the door if recessed and of sufficient size to limit the temperature rise through the enclosure or ambient compensated heater elements shall be provided.

PART 3 - EXECUTION:

3.1 INSTALLATION OF MOTORS:

A. All motors shall be open, drip-proof, 40°C rise, continuous duty, NEMA standard as manufactured by Westinghouse, Wagner or Century.

B. Each motor horsepower scheduled or specified is the minimum acceptable and shall have a nameplate rating of not less than 10% above break horsepower. If horsepower or KW ratings are increased, contractor who supplied equipment will be responsible for increase in motor starter size, wiring and circuit breaker in panel.

3.2 COORDINATION:

A. The HVAC contractor shall coordinate with the other contractors as required to produce workable, controllable systems. Generally, all controls and equipment shall be furnished and installed by this contractor unless otherwise noted. Specific examples of coordination and cooperation include:

1. All wiring between sensors and controlling devices shall be provided in accordance with the motor control schedule.

3.3 INSTALLATION OF CONTROLLERS AND CONTROLS:

A. Contractor shall provide motor controls and controllers packaged with equipment where specified or shown on Motor Control Schedule.

3.4 ELECTRICAL POWER WIRING:

A. Power wiring provided under Division 23 shall conform to Division 26 – Electrical requirements.

END OF SECTION 23 05 13

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PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this section.

1.2 WORK INCLUDED

A. Provide complete noise and vibration control systems as shown or specified and in accordance with the requirements of the Contract Documents. System shall be complete with:

1. Foundations and supports for rigidly supported equipment.
2. Vibration Isolation Equipment
3. Fan and Duct System Acoustic Plenums
4. Sealing Around Services Penetrations Through Walls and Slabs

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Consult all other Sections to determine the extent of work specified elsewhere but related to this Section. This work shall be properly coordinated to produce an installation satisfactory to the Owner. This work includes, but is not limited to the following:

1. Fans
2. Ductwork
3. Duct Insulation (External)
4. Internal (Acoustical) Duct Liner
5. Heating and Cooling Equipment
6. Concrete Housekeeping Pads
7. Sealant

1.4 CONTRACTOR'S RESPONSIBILITY

A. The HVAC Contractor shall be responsible for verifying the completeness of the isolation installation and the overall suitability of the equipment to meet the intent of this specification. The HVAC Contractor, even if not specifically mentioned herein or in the Contract Documents, shall supply any additional equipment needed to meet the intent of this specification, without claim for additional payment.

B. Performance or waiving of inspection, testing or surveillance for any portion of the Work shall not relieve the Contractor of the responsibility to conform strictly to the Contract Documents. The HVAC Contractor shall not construe performance or waiving of inspection, testing or surveillance by the Owner or Architects to relieve the Contractor from total responsibility to perform in strict accordance with the Contract Documents.

C. The intent of the designers is that there are no conflicts between this and other sections of the specification. If conflicts are discovered between this section and any other section or subsection of 23, it shall be the HVAC contractor’s responsibility to immediately bring this fact to the architect’s attention and request instruction. Absent that instruction, the contractor shall assume that this current section shall overrule in any conflicts.

1.5 MANUFACTURER'S RESPONSIBILITIES

A. Manufacturer of vibration isolation equipment shall have the following responsibilities:

1. Provide piping and equipment isolation systems as scheduled or specified.

2. Guarantee specified isolation system deflection.

3. Provide installation instructions, drawings and field supervision to assure proper installation and performance.

4. The vibration isolation systems shall be guaranteed to have deflection indicated on the schedule on the drawings. The mounting manufacturer shall determine mounting sizes and the sizes shall be installed in accordance with the manufacturer's instructions.

5. The vibration isolator vendor shall ensure that all equipment to be isolated has sufficient support structure to distribute equipment loads onto isolators. Where additional support structure is required, vibration isolator vendor shall provide this.

1.6 BID PROPOSALS

A. The HVAC Contractor shall submit at the time of bidding the names and qualifications of the noise and vibration control supplier(s). If a supplier is not one of the pre-approved vendors, then the submittal shall be accompanied by a complete catalog of that supplier's products and samples of each proposed vibration isolator.

1.7 SUBMITTALS

A. The HVAC contractor shall submit fully coordinated shop drawings for all vibration and noise control equipment. These submittals shall state the acoustical performance of the products as described below.

1. Sheet Metal: Coordinated shop drawings at 1/4” = 1’ -0” minimum scale shall be submitted for review and approval to indicate the following:

   a. Length, width, height and elevation of bottom of each duct segment
   b. Clearly indicated locations of duct silencers, fire dampers, combination fire/smoke dampers and balancing dampers
   c. Transition segments marked with entrance and exit sizes, as well as length and elevation
   d. Indication of duct offsets in the horizontal or vertical direction
   e. Duct lining thickness, including, if it changes, where it changes

2. Isolators: Submittal to the Architect shall include drawings prepared by the isolation materials manufacturer showing the construction of the isolation devices to be used, including specific selection of isolators for the equipment to be furnished for this project.

3. Submittal of vibration isolation system schedule indicating the following:

   a. Manufacturer, type, model number, size
   b. Height when uncompressed and static deflection of each isolation element
   c. Spring constant of each isolation element
   d. Estimated imposed load on each isolation element

e. Spring o. d., free operating and solid heights
f. Design of supplementary bases, if any
g. Layout of isolator hangers, mounts and other elements shown on an outline of the isolated equipment, including complete details of attachment to load-bearing structure or supplementary framing
h. Piping isolators shown and identified on piping layout drawing
i. All concrete foundations and supports (and required reinforcing and forms) will be furnished and installed by mechanical contractor and shall furnish shop drawings showing adequate concrete reinforcing steel details and templates for all concrete foundations and supports and all required hanger bolts and other accessories necessary for the proper installation of his equipment. All concrete work, all such work shall be shown in detail on the shop drawings, prepared by this trade and drawings shall be submitted showing the complete details of all foundations including necessary concrete and steel work, vibration isolation devices, etc.

1.8 SEALING OF PENETRATIONS

A. Building structures meant to isolate air-borne noise surround the noise critical spaces and spaces that contain noise, i.e. mechanical equipment rooms. These building structures must be massive, airtight constructions. The effectiveness of sound isolating structures can be severely compromised by penetrations for ductwork and piping. Proper sealing and/or lagging (enclosure) around mechanical services penetrating these structures will maintain the integrity of the isolating structure.

B. Foam Rod - Foam Rod is used to seal around duct penetrations as they pass through block work or concrete.

C. Non-Hardening Sealant - Non-Hardening Sealant is used to seal the Foam Rod to the ducts and to the construction through which the ducts penetrate.

1.9 QUALITY ASSURANCE

A. It is the objective of this Specification to provide for the control of noise and vibration due to the operation of machinery or equipment, and/or due to interconnected piping, ductwork or conduit.

B. A single manufacturer shall provide all vibration isolation equipment and materials. The following manufacturers are approved provided systems are in compliance with the specified design and performance requirements. The project acoustics consultant must approve any others.

1. Mason Industries, Inc., Hauppauge, New York
2. Amber Booth, Houston, Texas
3. Kinetics Noise Control, Dublin, Ohio

C. The following duct liner manufacturers are approved, provided the product is in compliance with the specified design and performance requirements. The project acoustics consultant must approve any others.

1. Certainteed
2. Owens-Corning
3. Knauff

PART 2 - PRODUCTS

2.1 GENERAL

A. All equipment provided for vibration isolation or noise control shall be new and manufactured specifically for the purpose intended.

2.2 INTERNAL ACOUSTICAL DUCT LINING

A. Duct liner shall comply with the requirement of NFPA 90A and the “Duct Liner Materials Standard” of the Thermal Insulation Manufacturer’s Association.

B. Sizes shown on the drawings are sheet metal clear dimensions (after installation of duct liner).

C. All acoustical duct lining shall incorporate means to prevent fiber entrainment in the air stream.

D. Duct lining shall be 1” thick and have minimum density of 3.0 pcf.

E. Plenum lining shall be 1” thick and have minimum density of 3.0 pcf.

2.3 FOAM ROD

A. Foam backer rod shall be closed cell polyethylene suitable for use as a backing for non-hardening sealant.

2.4 NON-HARDENING SEALANT

A. Sealant for penetrations shall be non-hardening polysulphide type.

B. Permanently flexible, approved firestop putty may be used in lieu of the sealant on foam rod in noise critical walls that are also fire rated.

2.5 PACKING MATERIAL FOR PENETRATIONS

A. Mineral fiber; non-combustible; resistant to water, mildew and vermin. Expanding resilient foams manufactured for this purpose are an acceptable alternative only if the material density is at least 15 pcf (40 kg/m3).

2.6 FIRE DAMPERS:

A. Fire dampers shall be a type with the blade stored out of the air stream.

2.7 FLEXIBLE DUCT CONNECTORS

A. Flexible sleeves for duct connections shall be fabricated from flexible, airtight, flame-retarded or noncombustible fabrics, coating and adhesives complying with UL Standard 181 Class 1.

B. Extra-Wide Metal-Edged Connectors: Factory-fabricated with a strip of fabric 5-3/4 inches wide attached to 2 strips of 2-3/4” wide, 24-gauge galvanized sheet steel or 0.032-gauge aluminum sheets. Select metal compatible with connected duct system. Fold and crimp metal edge strips onto fabric as illustrated in SMACNA HVAC Duct Standard, 1 st Edition, Figure 2-19.

1. Fabric: Glass fabric double coated with polychloroprene.
2. Minimum Weight: 26 oz per square yard
3. Tensile Strength: 480 lb/in in the wrap and 360 lb/in in the filling.

2.8 VIBRATION ISOLATION SYSTEMS

A. The static deflection of isolators shall be as given in the equipment schedule and specified below. The isolator schedule shall take precedence.

B. The vibration isolator supplier shall determine vibration isolator sizes and layout.

C. All vibration isolators shall have either known undeflected heights or calibration markings so that, after adjustment, verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.

D. All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer and must be linear over a deflection range of not less than 50% above the design deflection.

E. The theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment as a whole by more than ±10%.

F. All neoprene mountings shall have a Shore hardness of 30 to 60 ±5, or as specified herein, after minimum aging of 20 days or corresponding over-aging.

G. Housed or caged spring isolators are not acceptable.

H. Where steel spring isolation systems are described in the specifications, the mounting assemblies shall utilize bare springs with the spring diameter not less than 0.8 of the loaded operating height of the spring. Each spring isolator shall be designed and installed so that the ends of the spring remain parallel during and after the spring installation. All isolators shall operate in the linear portion of their load versus deflection curve and have 50% excess capacity without becoming coil bound.

I. All mounting systems exposed to weather and other corrosive environments shall be protected with factory corrosion resistance. All metal parts of mountings (except springs and hardware) shall be hot dip galvanized. Springs shall be cadmium plated and neoprene coated. Nuts and bolts shall be cadmium plated.

2.9 ISOLATOR TYPE DDNH

A. Type DDNH (Double Deflection Neoprene Hangers) shall consist of a molded neoprene isolating element in a steel hanger box. A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 3/4 inch larger than the diameter of the hanger rod and permit the hanger rod to swing through a 30 degree arc. When installed, the hanger box shall be allowed to rotate through a full 360 degrees without encountering any obstructions.

B. The isolator shall be manufactured with bridge bearing quality neoprene and selected for a maximum durometer of 50 and designed for 15% strain. Unless otherwise specified, the static deflection of DDNH hangers shall be 0.3 inches.

C. (Type DDNH: Mason Industries Type HD or as approved.)

2.10 ISOLATOR TYPE RBA

A. Type RBA isolators shall be designed with a neoprene element to provide isolation in tension, shear or compression. Neoprene to bridge bearing quality with a maximum durometer of 50.

B. (Type RBA: Mason Industries Type RBA or as approved)

2.11 ISOLATOR TYPE SPNM

A. Type SPNM (Spring and Neoprene Mounts) shall have a free-standing and laterally stable steel spring without any housing. Springs shall be designed so that the ratio of the horizontal to vertical spring constant is between one and two. The spring diameter shall be not less than 80% of the compressed height of the spring at rated load. Loaded springs shall have a minimum additional travel to solid equal to 50% of the specified static deflection.

B. Unless otherwise specified, the minimum static deflection of SPNM isolators for equipment mounted on grade slabs shall be 1 inch and the minimum static deflection for equipment mounted above grade level shall be 2 inches.

C. Two Type WP isolation pads sandwiching a 16 gauge stainless or galvanized steel separator plate shall be bonded to the isolator baseplate.

D. Unless otherwise specified, isolators need not be bolted to the floor for indoor installations. If the base plates are bolted to the structure, a neoprene vibration isolation washer and sleeve (Uniroyal Type 620/660 or as approved) shall be installed under the bolt head between the steel washer and the base plate.

E. (Type SPNM: Mason Industries Type SLFSW or as approved.)

2.12 ISOLATOR TYPE SPNH

A. Type SPNH (Spring & Neoprene Hangers) shall consist of a steel spring in series with a neoprene element. The spring shall have a minimum additional travel to solid equal to 50% of specified deflection. Neoprene element shall have static deflection of not less than 0.3” with a strain not exceeding 15%.

B. Unless otherwise specified, the static deflection of SPNH hangers shall be 2”.

C. Spring diameter and hanger box hole size shall be large enough to permit the hanger rod to swing through a 30 degree arc. A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 3/4 inch larger than the diameter of the hanger rod. When installed, the spring element shall not be cocked and the hanger box shall be allowed to rotate through a full 360 degree arc without encountering any obstructions.

D. (Type SPNH: Mason Industries Type 30N or as approved.)

2.13 ISOLATOR TYPE CSNM

A. Type CSNM (Constrained Spring and Neoprene Mounts) shall be a spring and neoprene mount that incorporates a housing which incorporates unrestrained stable springs with built-

in leveling device and resilient vertical limit stops to prevent spring elongation when partial load is removed and limits the movement of equipment when it is subjected to wind loading.

B. A minimum clearance of 1 inch shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring operation. Limit stops shall provide minimum 1/4” clearance under normal operation and a neoprene washer shall be installed beneath the bolt head/washer used to restrain the isolator.

C. In installations subject to wind load, provide tapped hole in top and bottom plates for bolting to equipment and the roof or supporting structure with a neoprene mounting sleeve.

D. Provide minimum 1/4” inch thick neoprene acoustical base pad on underside of mount unless designated otherwise.

E. Mount shall be capable of supporting equipment at a fixed elevation during equipment erection. Installed and operating heights shall be identical.

F. Unless otherwise specified, the minimum static deflection for Type CSNM mounts shall be 2 inches.

G. (Type CSNM: Mason Industries Type SLR or as approved)

2.14 BASE TYPE CB

A. Inertia base Type CB (Concrete Base) shall have an integral rectangular structural steel form into which concrete is poured.

B. Perimeter members shall be beams of depth equal to 10% of the longest span of the base, but not more than 12 inches nor less than 6 inches deep. Forms shall include motor slide base and all reinforcing steel. Where anchor bolt locations fall in concrete, the reinforcing steel shall include drilled members with sleeves welded below the steel to accept the anchor bolts. Height saving steel brackets shall be used in all mounting locations.

C. When the concrete base is "T" shaped, isolators shall be located under the projections as well as under the main body in order to prevent cantilever distortion.

D. The structural perimeter frame, mounting templates, height saving brackets and spring system shall be provided as an assembly by the vibration control vendor.

E. (Base Type CB: Mason Industries Type KSLFSW or as approved)

PART 3 - EXECUTION

3.1 GENERAL

A. All equipment, piping, etc. shall be mounted on or suspended from approved foundations and supports, all as specified herein, or as shown on the drawings.

B. All floor-mounted equipment shall be erected on 4" thick concrete housekeeping pads over the complete floor area of the equipment, unless otherwise specified to the contrary herein. These pads shall be integrally keyed to structural slab. Wherever vibration eliminating devices and/or concrete inertia blocks are specified, these items shall, in all cases, be in turn mounted on concrete housekeeping pads unless otherwise specified to the contrary herein.

C. Furnish and install neoprene mounting sleeves for hold-down bolts to prevent any metal to metal contact.

D. All equipment shall be provided with lateral restraining isolators as required to limit horizontal motion to 1/4" maximum, under all operating conditions. Lateral restraining isolators shall have the same static deflection as equipment being isolated.

E. Unless otherwise indicated, all equipment mounted on vibration isolators shall have a minimum operating clearance of 2 inches between the bottom of the equipment or inertia base (and height-saving bracket) and the concrete housekeeping pad (or bolt heads) beneath the equipment. The clearance shall be checked by the Contractor to ensure that no material has been left to short- circuit the vibration isolators. There shall be a minimum 4 inch clearance between isolated equipment and the walls, ceiling, floors, columns and any other equipment not installed on vibration isolators.

F. Piping, ductwork, conduit or mechanical equipment shall be supported from building structure, not hung from or supported on other equipment, pipes, or ductwork.

G. Equipment connected to water or other fluid piping shall be erected on isolators or isolated foundations at correct operating heights prior to connection of piping and blocked-up with temporary shims to final operating height. When the system is assembled and fluid is added, the isolators shall be adjusted to allow removal of the shims.

H. All mechanical equipment not specifically identified in this specification that contains rotating or vibrating elements and any associated electrical apparatus installed by this division that contains transformers or inductors shall be installed on Type DDNM or RBA neoprene isolators as appropriate.

I. All wiring connections to mechanical equipment on isolators shall be made with a minimum 36 inch long flexible conduit in a 360 degree loop.

J. Springs shall be designed and installed so that ends of springs remain parallel and all springs installed with adjustment bolts.

K. Springs shall be sized to be non-resonant with equipment forcing frequencies or support structure natural frequencies.

L. Refer to Vibration Isolation Schedule at the end of this Section.

3.2 FAN ISOLATION - GENERAL

A. Fans shall be mounted on vibration isolators as described herein, as shown on the equipment schedule and on the drawings.

B. Fans and air handling units shall be leveled with the fans operating before the flexible connectors are attached.

C. All fan bases and isolators shall be sized so that thrust restraints (which would act against turning moment caused by static pressure) are not required.

3.3 SUPPORTS

A. Piping supports within shafts shall be provided with suitable bearing plates and two layers 1/4" thick ribbed or waffled neoprene pad loaded for 50 psi maximum. The isolation pads shall be separated with 1/4" steel plate.

B. The isolation pads shall be Mason Industries Type W or approved equal.

C. Piping isolation supports at the base of risers shall be two layers of 1/2" thick heavy duty neoprene and canvas duct isolation pad separated by 1/4" thick steel plate. Suitable bearing plates sized to provide a pad loading of 500 psi maximum shall be provided. The stanchion between the pipe and isolation support shall be welded to the pipe and welded or bolted to the isolation support. The isolation support shall be bolted to the floor slab with resilient sleeves and washers.

D. All pipe support resilient materials shall be HL Mason Industries, Inc., or as approved.

3.4 DUCT SUPPORTS

A. Ducts within 25 feet of mechanical equipment shall be supported by neoprene hangers, Type DDNH.

3.5 PIPE RISERS

A. Where pipes rise in a vertical chase and are supported from a structure with type SPNH or DDNH isolators and require lateral bracing, neoprene riser guides shall be mounted around the pipe to limit lateral movement and to prevent direct contact with the supporting structure.

3.6 DUCT ISOLATION

A. Ducts shall be connected to fans, fan casings and plenums by means of flexible connectors. Flexible connectors shall be installed to prevent metal-to-metal contact across flexible connection. Flexible duct connectors shall not be used outside the mechanical room unless expressly shown on the drawings.

3.7 DUCTWORK FABRICATION

A. Fabricate ductwork so as to be free from vibration, rattle or drumming under all operating conditions; provide all materials necessary for specified construction, whether or not they are specifically called for or detailed on the drawings.

3.8 BRACING OF DUCTWORK

A. Install tie rods within ducts as required.

3.9 ACOUSTICAL LINING OF DUCTS

A. Ducts where noted, shall be acoustically lined internally. No supply and return systems shall be lined.

B. Acoustical duct lining shall be 1inch thick in ducts and where shown on the drawings. All lining shall be neoprene acoustical liner, similar to K-Flex or Armaflex, closed-cell type.

C. The acoustical liner shall be fixed to the duct with a minimum of 50% coverage of a fire-resistant adhesive. Where the duct width exceeds 12 inches or the height 24 inches, the liner shall be additionally secured with mechanical fastening on maximum 16 inch centers on all sides. Mechanical fasteners that pierce the duct are unacceptable. All ends of the liner shall be coated with a fire resistant cementing material to prevent delamination, leakage or erosion. All joints shall be firmly butted and ends coated with an adhesive to ensure that the lining is smooth across all joints.

D. Where acoustical duct lining is installed, the dimensions shown on the mechanical drawings are the clear external dimensions after the liner has been installed.

3.10 LINING OF ACOUSTICAL PLENUMS

A. Unless otherwise specified, acoustical plenums shall be lined with 1 inch thick neoprene duct liner of at least 3-lb density.

3.11 SHEET METAL AND PIPING PENETRATIONS OF SHAFTS, FLOOR SLAB AND/OR PARTITIONS

A. There shall be no direct contact of Sheet Metal or piping with shaft walls, floor slabs and/or partition.

B. All openings around pipes and ducts in the structure surrounding the mechanical equipment and surrounding spaces shall be sealed packed with caulking for the full depth of the penetration, as described herein and as shown on the drawings. This includes all slab penetrations and penetrations of walls.

3.12 DUCT PENETRATIONS

A. Where each duct passes through a wall, floor or ceiling, there shall be a clear annular space of 1 inch between the duct and structure. After all of the ductwork is installed the Contractor shall check the clearance, pack the voids full depth with mineral fiber batt insulation and caulk both ends with a non-aging, non-hardening sealant backed by a polyethylene foam rod or permanently flexible firestop material. Where there is not sufficient access space to pack around all sides of a duct (for example, at the underside of a slab), place a short stub duct in the wall, pack and caulk around it and then attach the inlet and outlet ducts to each end.

3.13 ROOFTOP EQUIPMENT

A. Packaged Equipment Curbs: Provide 2” spring isolation curbs for all rooftop packaged HVAC equipment. Curbs shall be seismically rated in design category C and D.

B. All utility set fans shall be installed on 2” spring rails over 12” high x 4” wide x minimum 36” length.

C. All final connections to roof mounted equipment shall be done using flexible connections.

3.14 DAMPERS

A. Dampers shall be installed only where shown on the drawings.

B. Combination dampers shall be installed where specifically called out on the drawings

3.15 WIRING

A. All wiring connections to mechanical equipment on vibration isolators (either spring or neoprene type) shall be made with a minimum 36 inch (1m) long flexible conduit in a 360 degree loop. This Contractor shall coordinate wiring connections with the Electrical Contractor.

3.16 FIELD QUALITY

A. HVAC Contractor shall work in accord with best trade practices, shall fabricate and install all items in accordance with manufacturer's recommendations and Architect's directions and shall consult with trades doing adjoining work in order to provide an installation of first class quality.

END OF SECTION 23 05 29

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PART 1 - GENERAL

1.1 SCOPE:

A. All exposed pipe, hangers, and equipment installed by HVAC contractor shall be painted unless it has a factory finish or is noted otherwise. Exposed chromeplated brass, stainless steel, or plastic piping will not be painted.

B. Type of identification devices specified in this section include the following:

1. Plastic Pipe Markers
2. Plastic Tape
3. Valve Tags
4. Valve Schedule Frames
5. Engraved Plastic-Laminate Signs

1.2 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. ANSI Standards: Comply with ANSI A13.1 for lettering size, colors, and viewing angles of identification devices.

1.3 SUBMITTALS:

A. Product Data: Submit product specifications and installation instructions for each identification material and device required.

B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.

C. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags," in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 01.

PART 2 - PRODUCTS:

2.1 PLASTIC PIPE MARKERS:

A. General: Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, color-coded, plastic-sheet pipe markers, complying with ANSI A13.1.

B. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:

1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.

2. Adhesive lap joint in pipe marker overlap.

3. Laminated or bonded application of pipe marker to pipe (or insulation).

4. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".

C. Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:

1. Laminated or bonded application of pipe marker to pipe (or insulation).

2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2" wide; full circle at both ends of pipe marker, tape lapped 3".

3. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.

D. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.

E. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

2.2 PLASTIC TAPE:

A. General: Manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

B. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2-1/2" wide tape for larger pipes.

C. Color: Comply with ANSI A13.1, except where another color selection is indicated.

2.3 VALVE TAGS:

A. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener. Provide 1-1/2" diameter tags, except as otherwise indicated.

B. Valve Tag Fasteners: Manufacturer's standard solid brass chain (wire link or beaded type), the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

2.4 VALVE SCHEDULE FRAMES:

A. For each page of the valve schedule, provide a glazed display frame, with screws for removable mounting on walls. Provide frames of rigid plastic or metal, with plastic glazing. Install in mechanical room.

2.5 ENGRAVED PLASTIC-LAMINATE SIGNS:

A. Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.

C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.6 LETTERING AND GRAPHICS:

A. Coordinate names, abbreviations and other designations used in mechanical identification work with corresponding designations shown pre-existing, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer's or as required for proper identification and operation/maintenance of mechanical systems and equipment.

B. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 1, AHU-1.

2.7 PAINT:

A. All products shall be in accordance with the specifications for painting in the general contract.

PART 3 - EXECUTION:

3.1 GENERAL:

A. Any equipment shipped with a factory applied finish shall be touched up to repair any damage to the finish so that it is the same as new.

B. In the mechanical equipment rooms the HVAC contractor shall be responsible for painting all piping, equipment, and accessories installed under their respective contract.

C. In other parts of the buildings items which are in place in finished areas when general building painting is done will be painted by the General Contractor. Items installed after painting is completed shall be painted by the HVAC contractor, as directed by the architect.

D. All exposed nongalvanized ferrous metal hangers and miscellaneous metal used in connection with the HVAC systems shall be painted with two coats of enamel.

E. All exposed piping including insulated piping, insulated by HVAC contractor shall be painted two coats of oil paint. Elastomeric pipe insulation shall have two coats of enamel of the type recommended by the insulation manufacturer.

F. Do not field paint exposed copper pipe, brass valves, or brass trim on iron body valves, or machinery or equipment that has a factory applied finish unless otherwise specified. Do not paint plastic pipe.

G. Painted pipes which are buried in earth, shall be allowed to dry before backfilling.

H. All paint shall be delivered to the project in unbroken containers. Containers shall be labeled to indicate color, directions for use, manufacture, and date of manufacturer. Directions for use of the paint shall be carefully followed in the mixing and general application. All paint shall be applied under dry and dust free conditions. Sufficient time shall elapse between paint coats to permit satisfactory recoating. Once started all painting shall be completed without delay.

3.2 DUCTWORK IDENTIFICATION:

A. General: Identify air supply, return, exhaust, intake and relief ductwork with plastic signs and arrows, showing ductwork service and direction of flow, in black or white (whichever provides most contrast with ductwork color).

B. Location: In each space where ductwork is exposed, or concealed only by removable ceiling system, locate signs near points where ductwork originates or continues into concealed enclosures (shaft, underground or similar concealment), and at 50' spacing along exposed runs.

C. Access Doors: Provide plastic-laminate type signs on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety in procedural information.

D. Concealed Doors: Where access doors are concealed above acoustical ceilings or similar concealment, plasticized tags may be installed for identification in lieu of specified signs, at Installer's option.

3.3 PIPING SYSTEM IDENTIFICATION:

A. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums), exterior non-concealed locations and above removable acoustical ceilings.

1. Near each valve and control device.

2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.

3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.

4. At access doors, manholes and similar access points which permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.

7. On piping above removable acoustical ceilings.

3.4 PAINT SCHEDULE:

A. All exposed equipment, pipes, conduits, or other appurtenances shall be painted by this sub-contractor with materials and application as specified in the general contract specifications and as directed by the architect.

B. All concealed pipe covering shall be identified by colored bands and legends. The direction of flow shall be indicated by flow arrows.

C. All exposed pipe covering shall be totally painted the color of the band color listed below. All exposed pipe hangers, rods, supports, channels, etc. shall be painted flat black.

D. Directions arrow and fluid name shall be applied by sticker at same spacing as above. The stickers shall be secured by color coded tape wrapped two times around the pipe at each end of the label or spring cords.

3.5 PIPE AND DUCT IDENTIFICATION:

A. Piping systems in mechanical rooms shall be completely painted with the applicable colors listed below and have appropriate self-sticking or strap-on identifications and arrows indicating direction of flow. Piping and ducts in chases above ceiling, etc. should be color banded and have stencil markings at appropriate intervals. On straight runs of piping, markings should be no further than 30 feet apart; and stencil identifications, color bands, and direction arrows should be near each valve, pressure reducing valve, heat exchanger, etc. Where pipe passes through walls or floor, marking should be near the penetration on both sides. Markings should be at each directional change of all piping systems. Mechanical room pipe color and the color of bands shall be as follows:

PIPING SYSTEMS AND CONTENTS	STENCIL COLOR	IDENTIFICATION
Water, Condenser Supply	Green	CWS
Water, Condenser Return	Green	CWR
Condensate Drain	Green	COND.
Water, Make-Up	Dark Blue DOM CW	
Water, Hot, Heating, Supply	Red	HWS
Water, Hot, Heating, Return	Red	HWR
Ductwork	Black	
Supports, Hangers	Vacuum Black	
Refrigerant	Black on Yellow	

B. Pipe identification should contrast in color to the pipe colors and be easily readable. The width of color bands should be equal to the size of the stencil indicated below.

C. For insulated pipe systems, stencil sizes should be as follows:

D. For un-insulated systems, stencil sizes should be as follows:

1. For pipe diameters up to 1 inch, use 1/2 inch letters.
2. For pipe diameters from 1 inch to 2 inches, use 1 inch letters.
3. For pipe diameters from 2 inches to 6 inches, use 2 inch letters.

3.6 VALVE IDENTIFICATION:

A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, HVAC terminal devices, and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

B. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Architect/Engineer.

C. Where more than one major machine room is shown for project, install mounted valve schedule in each major machine room, and repeat only main valves which are to be operated in conjunction with operation of more than single machine room.

3.7 MECHANICAL EQUIPMENT IDENTIFICATION:

A. General: Install engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:

1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.

2. Pumps, chillers, and similar motor-driven units.

3. Fans, blowers, primary balancing dampers and mixing boxes.

4. Packaged HVAC and central-station units.

5. Tanks and pressure vessels.

B. Lettering Size: Minimum 3/8" high lettering for name of unit where viewing distance is less than 2'-0", 3/4" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 the size of principal lettering.

C. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, and warn of hazards and improper operations.

D. Operational valves and similar minor equipment items located in non-occupied spaces (including machine rooms) may, at installer's option, be identified by installation of plasticized tags in lieu of engraved plastic signs.

E. Where terminal units or other equipment are installed above accessible lay-in ceilings, provide ½" engraved tags attached to ceiling grid directly below unit. White letters. Blue background.

END OF SECTION 23 05 53

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PART 1 - GENERAL

1.1 SCOPE:

A. This work includes testing all mechanical equipment to determine that its performance is in compliance with the requirements of the contract documents and the adjustment and balancing of the systems so that fluid quantities are delivered to locations as required by the contract documents and that the temperature, humidity, and/or volume can be controlled in accordance with the design intent and space requirements. This work shall not imply a guarantee of the total system, nor shall it relieve sub-contractors or manufacturers of their normal responsibilities.

B. The mechanical contractor shall perform all work described in preparation of equipment and systems for testing and balancing.

C. The actual testing and balancing shall be performed by a separate firm specializing in testing and balancing of mechanical equipment hired by mechanical contractor. The T&B contractor to the mechanical contractor shall be a member of NEBB or TAB. The T&B contractor shall be pre-qualified and approved by A/E.

D. Testing and balance shall not begin until the system has been completed and is in full working order. The mechanical contractor shall put all heating, ventilating, and air conditioning systems and equipment into full operation and shall continue the operation of same during each working day of testing and balancing.

E. The mechanical contractor shall pay the costs of operating the mechanical equipment during the testing and balancing period unless operation of system is required by the general contractor. He shall make arrangements with the General Contractor to pay for his electrical power and water.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PREPARATION OF EQUIPMENT FOR TESTING AND BALANCING:

A. The mechanical contractor shall, upon completion of items of work required by his contract and prior to the commencement of the Testing and Balancing Subcontract, as hereinafter specified, thoroughly clean all dirt and debris from equipment, ducts, piping systems, fixtures, strainers, accessories, etc. All bearings, gear boxes, wearing surfaces, or other equipment components requiring lubrication shall be properly serviced as recommended by the equipment manufacturer, and shall be tagged with the date of service and type of lubricant used All specified cleaning and protective devices shall then be installed in equipment, piping, plenums, ductwork, etc., and systems shall be placed in continuous operation. All fans shall have been in operation for at least twenty-four hours prior to the start of testing and balancing so that initial stretch of drive belts will have taken place, and all other mechanical equipment, including temperature and operating control devices shall have been adjusted and calibrated for complete and functional operating service.

B. The mechanical contractor shall provide the Testing and Balancing Contractor at the earliest possible time, copies of all approved equipment, specialties, and control submittal data, together with a set of contract plans and specifications.

C. The mechanical contractor shall provide all thermometer wells, pressure gauge connections, capped duct thermometer openings, etc., as the T&B contractor require. The T&B contractor shall assist the mechanical contractor in locating these devices as the job progresses.

D. The mechanical contractor shall provide sufficient time from the complete installation of all systems to the final established completion date of this project so that testing and balancing can be accomplished.

3.2 TESTING AND BALANCING SUBCONTRACT:

A. Testing, adjusting and balancing shall be performed in accordance with the latest edition of ASHRAE Guide, National Standards for Field Measurements and Instrumentation by the Associated Air Balance Council and the SMACNA Manual for the Balance and Adjustment of Air Distribution Systems.

B. Submit copies of the proposed test report form for the Engineer's approval before beginning tests. Provide operating curves of equipment. Submit a complete description of all tests proposed in accordance with the shop drawing requirements. Submit copies of all report forms, data sheets, and instrumentation to be used. This submittal data shall include a tabulation of all instruments and devices to be utilized in the performance of testing and balancing operations, and shall include the name of the manufacturer of the instrument or device, model number, range, degree of accuracy, date of last calibration, and how calibrated, or other pertinent information that may be required to determine the utility of the instrument or device.

C. Balance, adjust and test air moving equipment and air distribution of supply and exhaust systems and all water systems as herein specified. All work by T&B contractor shall be done under direct supervision of a qualified air conditioning engineer. All instruments used shall be accurately calibrated and maintained in good working order. If requested, the tests shall be conducted in the presence of the Engineer responsible for the project and/or in his representative.

D. Evidence of qualification shall be P.E. registration, AABC certification, or NEBB certification satisfactory to the Engineer. Submit resumes of all key personnel with the shop drawings.

3.3 START-UP TEST OF EQUIPMENT:

A. Witness and report on the accuracy of the manufacturer's start-up test of equipment. Include copies of these reports in the verification report. Read and record the amperage on each phase of each motor and each circuit of each electrical heater or coil. Measure again under full load to calculate horsepower for performance test. Record nameplate voltage and amps of motors, coils, and all other electrical equipment and trip amps of thermal overloads. All equipment which is not field tested by the manufacturers shall be performance tested and adjusted by the T&B contractor.

3.4 TEMPERATURE CONTROL:

A. Witness the performance and start-up of the temperature control system and report on any deficiencies which affect system performance. This shall include outdoor, return and

relief air damper operation from wide open to tight shut-off, leaving air controls and mixing dampers, mixing valves performance when in bypass as well as wide open. Record dry bulb and wet bulb temperatures in typical rooms comprising approximately 10% of total rooms.

3.5 AIR HANDLING HEATING AND COOLING UNITS:

A. Measure the cfm of air at the filter or coil section using a rotating vane velometer. Measure the static pressure and velocity at the inlet and outlet of each coil, filter, damper, fan, etc. Measure fan as required under "Fans," in the specification. Measure the total BTU/Hour of the cooling coil and heating coil by measuring entering and leaving DB and WB temperatures and pounds per hour of air flow (SCFM). Measure temperatures entering and leaving coils and compare BTU/Hour. Observe all joints for leaks and report them.

3.6 TERMINAL BOXES:

A. Read the inlet, outlet and differential pressure at the flow measuring taps supplied by the manufacturer on the box. Compare this to his calibration curve and record CFM. Total the CFM of all diffusers connected to each box and compare it to this reading. Both readings must agree with $\pm$ 3% of the specified air quantity.

3.7 HEATING COILS:

A. The CFM of each heating coil on a terminal box will be determined above. Read the entering and leaving air temperature and calculate the BTU/Hour capacity. Measure entering and leaving water temperature and calculate peak BTU/Hour capacity on 10% of the coils to confirm balance.

3.8 TESTING PROCEDURES FOR AIR HANDLING UNIT SYSTEMS:

A. Test and adjust blower RPM to design requirements. Record all pulley and belt data.

B. Test and record motor full load and operating amperes and voltage on all three phases.

C. Make pitot tube traverses of main supply ducts and obtain design CFM at fans. Also make velocity traverses of all coils and filter banks.

D. Test and record system static pressures, suction and discharge.

E. Test and adjust system for design recirculated air, CFM.

F. Test and adjust system for design CFM outside air.

G. Test and record entering air temperatures. (D.B. heating and cooling).

H. Test and record entering air temperatures. (W.B. cooling).

I. Test and record leaving air temperatures. (D.B. heating and cooling).

J. Test and record leaving air temperatures. (W.B. cooling)

K. Adjust all main supply, return, and exhaust air ducts to proper design CFM.

L. Adjust all zones to proper design CFM supply, return, and exhaust.

M. Test and adjust operation of frequency drives for fans.

N. Test and adjust each diffuser, grille, and register to within 5% of design requirements where several rooms are controlled as a zone.

O. Size, type, and manufacture of diffusers, grilles, registers, and all tested equipment shall be identified and listed. Manufacturer's ratings on all equipment shall be used to make required calculations and checked against field measurements.

P. All fire dampers shall be tested to prove they open and close properly.

Q. All diffusers, grilles, and registers shall be adjusted to minimize drafts and noise in all areas.

R. Verify correct system pressures.

S. As a part of the work of this contract, the mechanical contractor shall make any changes in the pulleys, belts, and dampers required for correct balance at no additional cost to Owner or engineer.

3.9 TESTING PROCEDURES FOR HYDRONIC SYSTEMS

A. Hydronic balancing procedures consist of attaining proportional fluid flow quantities throughout hydronic systems, in accordance with design requirements.

B. Preparing for Hydronic System Balancing: Hydronic system balance shall not begin until the NEBB test and balance agency has verified the following:

1. The system is completely filled.
2. The system is clean.
3. The system is free of air.
4. All services valves are open.
5. All strainers are provided with clean screens having proper perforations.
6. Control valves are piped properly.
7. All coils are correctly piped.
8. Coil fins are straight and clean.
9. Properly balancing devices (meters, pressure taps, thermometer wells, and balancing valves) are in place and correctly located.
10. Automatic temperature control system is in operation.
11. The pressure is adequate to completely fill the system.

C. The NEBB test and balance contractor shall measure the amperes of all pump motors before hydronic balancing is started, and shall take proper steps to correct and report any overloads.

D. The NEBB test and balance contractor shall not continue the hydronic balancing if, at any time, hazardous conditions are observed. Any such conditions shall be reported before proceeding further.

E. General Procedures:

1. All flow quantities, temperatures, and pressures shall be measured according to the NEBB National Standards.

2. If, during the hydronic balancing, the NEBB test and balance agency observes any conditions that will not permit proper balancing, those conditions shall be reported immediately.

3. If pressure differential is found to be inadequate or excessive, the balancing procedure shall be stopped until corrective action is taken.

F. Systems:

1. Constant Flow Systems: Where three-way temperature control valves are provided, the balancing valve in the bypass connection shall be restricted so that the flow through the bypass (with the three-way valve in the full bypass position) is the same as full flow through the coil.

2. Variable Flow Systems: Sufficient valves shall be opened or closed to simulate design diversity if applicable. All bypass systems shall be set.

G. Coil Banks:

1. To compensate for any stratification of air temperature or uneven air velocity across the coil bank, the water flow through banks of multiple coil sections shall be balanced thermally so the return water temperature of each coil is the same. The balancing valve of at least one coil shall be fully open.

H. Pumps:

1. If there are no meters in the system, the pump shall be used for estimating the total system flow rate.

I. Setting Pump Discharge Flow:

1. Setting Pump Flow By Modifying Impeller Size: Proportionally balance the terminals, fully open the discharge valve and calculate the new pump impeller diameter required to provide design flow to the terminals. The proper size impeller will be provided by the mechanical contractor.

J. After the modified impeller is installed, the test and balance agency shall measure:

1. Shutoff head.
2. Total GPM
3. Discharge pressure
4. Suction pressure
5. Voltage
6. Current

K. Measure water flow by flow meters; pressure differential across pumps and temperature differentials across heat exchangers. Balancing by temperature difference across air to water heat exchangers shall be done only after air balance is complete. Pressure shall be measured by standard or differential pressure gauges.

L. Instruments

1. All instruments used shall be certified as having been calibrated within a six month period prior to use.

2. Manufacturer, model and range of instruments used to make the various readings and measurements shall be listed in the written report.

M. Provide six copies of a report which shall contain the following information:

1. Fan and Pumps:

a. Manufacturer and model
b. Size, arrangement and class
c. Motor nameplate data
d. RPM
e. CFM or GPM
f. Pressure difference across fan or pump.
g. Ammeter readings
h. Voltmeter readings
i. Heater sizes
j. Standby pump for heating and cooling use independently.
k. For variable volume pumping systems, determine optimum differential pressure setpoint to achieve design flow at most remote coil.

3.10 SOUND TESTS:

A. In 10% of the rooms the T&B contractor shall make noise tests as described by the engineer in accordance with the ASHRAE Guide, and as herein specified.

B. Using approved instruments conduct tests in selected areas of the building as specified below. Sound level readings shall be measured in decibels on the "A" and "C" scales of the General Radio Company sound level meter, or equal sound level meter that meets the current American Standard (z24.3-1944) based on the acoustic reference power of dB/-re 10-13 watts. Readings shall set forth the total random sound level of the selected rooms or areas with the system in operation, as compared to total background sound level with the system not in operation. The system increase over the background levels shall be recorded in decibels on the "A" and "C" scales. If sound levels are above those listed, adjustments shall be made to bring the sound level within the range set forth. This shall be done with the equipment as installed, if possible. Record octave band readings in rooms where noise is above normal. Record dBA in 10% of rooms.

C. Sound levels in decibels at each diffuser, grille, or register in occupied area, shall be measured approximately five feet above the floor on a line approximately forty-five degrees to the center of the diffuser, etc., on the "A" and "C" scales of a General Radio Company sound level meter. Where it is apparent that noise level reading will be taken only one diffuser per room.

D. If it is not possible to achieve required noise levels with existing equipment, the areas having excessive noise levels shall be listed and recommendations shall be obtained from the engineer for corrective actions required to correct the sound problems.

3.11 REPORTS

A. Upon completion of testing and balancing of all systems, the test and balance agency shall submit 6 copies of neatly typed or printed certified test reports bearing the professional engineering seal of the T&B firms supervision engineer containing all compiled data and test results. Final inspection of the project will be made only after certified test reports are submitted showing that all systems have been balanced and performance tested. Any critical deviation of equipment capabilities or performance from

design and specification requirements shall be noted in the balancing and testing reports, together with any recommendation for efficient and economical correction of the deficiency, and shall be pointed out to the Engineer as soon as it is observed.

B. Settings of dampers, splitters, valves, pulleys and other volume adjusting devices shall be permanently marked after completion of balancing and adjusting, so that they can be restored if disturbed at any time.

3.12 COORDINATION:

A. All efforts of the test and balance contractor shall be coordinated with the mechanical contractor. Any installation or operational discrepancies found during the test and balance procedure shall be brought to the attention of the mechanical contractor and engineer. Such discrepancies shall be corrected and system retested and balanced before the completion of the final report.

3.13 COMMISSIONING:

A. The mechanical contractor and the test and balance contractor shall be a part of any commissioning effort that might be specified or required. Contractors shall provide such tests, documentation, reports, verification, and assistance as necessary to insure the satisfactory commissioning and operation of the mechanical systems in accordance with the “design intent”. Such effort shall be as directed by the engineer and/or an independent commissioning agent.

3.14 SYSTEM DEMONSTRATION:

A. The test and balance contractor shall assist the mechanical contractor in the demonstration of the completed mechanical system. Such demonstration shall occur in the presence of the engineer or commissioning agent and shall include such operational test and verifications as the engineer may direct.

3.15 CERTIFICATION AND WARRANTY:

A. Test and balance contractor shall certify the test and balance report to be a true, accurate, and complete accounting of the final operating conditions of the HVAC systems. During the mechanical contractor’s one year warranty, the test and balance contractor shall provide any retesting and/or verification required to satisfy the warranty requirements.

END OF SECTION 23 05 93

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PART 1 - GENERAL

1.1 SCOPE:

A. This work includes cleaning the various air and water systems, pressure testing to insure tightness, and start-up of the various systems to prove their operational capability.

PART 2 - PRODUCTS

2.1 GENERAL

A. This contractor shall provide all water and other materials used for testing.

PART 3 - EXECUTION

3.1 TESTING SYSTEMS:

A. Pipe pressure testing: Prior to testing, remove or otherwise protect from damage all control devices, trap bellows, air vents, or other devices not designed to withstand the test pressure.

B. Piping Pressure Tests: The following system shall be hydrostatically tested at a pressure of 1-1/2 times the normal working pressure, or 125 psi, whichever is greater:

1. Condenser and Hot Water Piping
2. Equipment Vents

C. All work must remain uncovered until required tests have been completed but in the event that the project construction schedule required it, this contractor shall make arrangements for prior tests on portions of the work involved. All costs of these tests shall be paid by this contractor. Any damage caused as a result of tests shall be repaired at the expense of this contractor.

D. It is desirable that each system be tested in its entirety, but the various systems may be tested in sections as may be required to expedite the work of other trades.

E. Test pressure shall be maintained without pumping for a minimum of 4 hours without loss of pressure other than may be attributable to changes in atmospheric conditions. Sweats or drips will not be accepted.

F. After satisfactory completion of tests and before permanently connecting equipment, traps, strainers, etc. flush entire pipe systems for sufficient length of time to free interiors completely of foreign matter.

3.2 LEAKAGE TESTING FOR MEDIUM PRESSURE DUCT SYSTEM:

A. The installed medium pressure duct system shall be sealed and SMACNA Class “A” leakage rating tested.

B. The air leakage at the test pressure shall be measured by a calibrated orifice type of flow meter.

C. If the system is tested in sections, the leakage rates shall be added to give the performance of the whole system.

D. Leakage concentrated at one point may result in objectionable noise even if the system passes the leakage rate criteria. This noise source must be corrected to the satisfaction of the engineer.

E. The orifice of flow measurement device must have been individually calibrated against a primary standard, and this calibrated curve permanently attached to the orifice tube assembly.

F. Testing must be in accordance with a printed procedure submitted to the engineer for approval.

3.3 TESTS FOR LOW PRESSURE DUCT:

A. All low pressure make-up supply, return and exhaust duct, plenums, casings shall be tested and made airtight before covering or concealing and shall be sealed and SMACNA Class “A” leakage rating tested.

B. Tests shall be made before insulation is applied to joints, fittings, or valves. The A/E representative shall be given the opportunity to observe all tests and items under test shall not be covered up until after the A/E representative has observed the test or has been given a letter waiving the right of observation of the test.

3.4 CLEANING OF SYSTEMS:

A. The inside of the air terminal units, ducts, plenums, and casings shall be thoroughly cleaned of all debris and blown free of all small particles of rubbish and dust and then shall be vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with all traces of oil, duct, dirt, or paint spots removed. Temporary filters shall be provided for all fans that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building and the ducts, plenums; casings, and other items specified hereinbefore have been vacuum cleaned. It shall be the responsibility of this contractor to maintain the system in this clean condition until final acceptance.

B. Clean all piping systems, equipment, and accessories (especially pumps, valves, flange faces, gauges, etc.) of cutting chips and foreign matter while installing.

C. Cleaning of piping systems shall be as described under Chemical Treatment.

D. Temporary bypasses shall be provided for all water coils to prevent flushing water from passing through coils.

3.5 GENERAL:

A. Be careful to provide all sight glasses, control valves, pumps, and any items that could be damaged by foreign material with 40 mesh screen on the inlet side, or bypass, or remove such items.

B. Clean out the strainers, air separators, and all low velocity areas where dirt accumulated.

C. Protect all water systems from freezing.

D. Clean all strainers and dirt legs.

3.6 START-UP AND TEST:

A. Each system shall be started up and a preliminary test made as follows:

1. This contractor shall make trail runs of each piece of equipment furnished by him. This contractor shall provide all oil, grease, and other lubricants for the operation of all equipment until acceptance. This contractor shall be held responsible for all damage to bearings while the equipment is being operated by him up-to-date of acceptance of the equipment, and for a period thereafter as per the general building warranty. The contractor shall be required to protect all bearings during installation and shall thoroughly grease steel shafts to prevent corrosion.

2. The contractor shall align each shaft and adjust all pulleys to run substantially vibration-free. Where equipment cannot be so adjusted by the contractor, the manufacturer shall provide a machinist or serviceman to make these adjustments. Vibration-free is construed to mean that rotating machinery shall not exceed a self-excited vibration velocity of 0.10 inches per second in any direction when measured with a vibration meter on the bearing caps of the machine.

3. Belts shall be checked for alignment and tightened to proper tension.

4. Overload elements in motor starts shall be checked and proper elements provided as required for the motor full load amp rating.

5. Glands, seals, etc. shall be examined and properly adjusted.

6. Air vents shall be bled.

7. Equipment shall be started per manufacturer's instructions and run in.

8. Read amperage and voltage on each motor the first time it is started, and check direction of rotation.

9. Run an operating test on each piece of equipment. The tests shall be sufficient to show that the equipment has been run and observed and shall include the following:

10. Each fan amp. draw and discharge static pressure.

11. Temperature of air entering and leaving each coil in air handling unit.

12. Pressure drop across each filter bank service other than individual rooms.

13. Volts and amps on each motor.

14. Results of preliminary tests shall be submitted before test and balance sub-contractor commences his work.

15. Test atrium smoke removal system with fire alarm contractor and in the presence of independent inspectors.

END OF SECTION 23 05 95

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PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Provide insulation as specified for:

1. Piping systems including valves, couplings, fittings, flanges, strainers, and expansion joints.

2. Ductwork, thermal insulation for all mixed, supply, return and outdoor air ductwork and casings, unless specifically noted otherwise.

3. Equipment, including tanks, valves and components subject to heat loss or heat gain, circuit setters.

4. Other items where shown on drawings and/or specified.

1.2 SUBMITTALS:

A. Shop drawings shall be submitted on all items in accordance with the provisions of specification Section 23 01 00.

B. Submit shop drawings on the following:

1. Insulation
2. Insulation Support Shields
3. Fitting Covers
4. Foam glass covers for circuit setters

1.3 RELATED WORK SPECIFIED ELSEWHERE:

A. In addition to this Section, this contractor shall refer to other specification sections and drawings to ascertain the extent of work, including: All Division 23 Sections.

1.4 DEFINITION:

A. Work under this section of the specifications shall include but not necessarily be limited to items common to sections:

1. 23 07 02 - Condensate Drain Piping Insulation
2. 23 07 06 - Duct Insulation

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENTS - PIPING INSULATION:

A. Insulation shall have composite (insulation jacket or facing, and adhesive used to adhere the facing or jacket to the insulation) fire and smoke hazard ratings as tested by procedure ASTM E84, NEPA 255 or UL 723 not exceeding:

1. Flame Spread-25
2. Smoke Developed 50

B. Accessories such as adhesives, mastics, cements, tapes and cloth for fittings shall have the same component rating as listed above. All products or their shipping cartons shall bear a label indicating that flame and smoke ratings do not exceed requirements. Treatment of jackets or facings to impart flame and smoke-safety shall be permanent. The use of water-soluable treatments is prohibited.

C. Where Benjamin-Foster adhesives are specified equal products manufactured by 3M Company, or the manufacturer of the insulation are acceptable upon approval by the Engineer. Armstrong 520 adhesive shall be used for Armstrong insulation.

D. In lieu of the insulation wrap specified for fittings, valves, mechanical couplings and flanges, unitary type insulation products similar to J-M Unifit shall be acceptable.

E. In lieu of longitudinal lap seam specified, self-sealing lapped jacket shall be acceptable with requirement for aluminum bands on concealed piping. Stapling of lap seam is not acceptable.

2.2 GENERAL PRODUCT REQUIREMENTS - DUCT INSULATION:

A. Duct insulation shall be flexible 3/4 (0.75) pound per cubic foot density glass fiber with a minimum R value of 6 at 75 deg F mean temperature, with reinforced foil-faced, flame resistant Kraft vapor barrier.

B. Insulation shall have a composite (insulation, jacket or facing, and adhesive) fire and smoke hazard ratings as tested by Procedure ASTM G84, NFPA 225 and/or UL 723 not exceeding:

1. Flame Spread-25
2. Smoke Developed-50

C. Insulation materials shall be as manufactured by Johns-Manville, Armstrong, Knauff, or Owens Corning.

PART 3 - EXECUTION

3.1 GENERAL EXECUTION REQUIREMENTS - PIPING:

A. Insulation shall be applied on clean dry surfaces, after inspection and release for insulation application. Items that are factory insulated shall not receive additional insulation.

B. Insulation shall be continuous through wall and ceiling openings and sleeves.

C. Insulation on cold surfaces where vapor barrier jackets are used shall be applied with a continuous, unbroken vapor seal. Anchors, etc., that are secured directly to cold services shall be adequately insulated and vapor sealed to prevent condensation. Paint welded joints with rust inhibitor before insulating pipe.

D. Where insulation is specified for piping, insulate similarly all connections, vents, drains, and any appurtenances and piping connected to system subject to heat loss or gain. Unions, couplings, or flanges provided at equipment for removal of heat exchanger, etc., shall be insulated with removable molded blocks.

E. Where inserts occur at pipe supports and guides, provide the following:

1. On hot pipe apply 3" wide vapor barrier tape or band over the butt joints.

2. On cold pipe apply a wet coat of vapor barrier lap cement on all butt joints and seal all joints with 3" wide vapor barrier tape or band.

F. Fittings, valves, mechanical couplings and flanges shall be insulated with the same material and of the same thickness as the adjoining piping, except where otherwise specified.

G. Concealed piping in chases, insulate with glass fiber insulation types shall be banded in place with three aluminum bands per section, one over each end of the joint sealing strip, and one in the middle of the section.

H. All exposed piping shall be finished with an 8 ounce canvas jacket posted to the insulation and if within 8'-0" of the floor shall be finished with an additional aluminum jacket (.016" preformed). Exposed fittings, etc. shall be finished with fitting cloth smoothly adhered and coated with Benjamin-Foster 30-36. Lap the cloth on itself and adjoining pipe insulation. Lap to be at least 1" on pipe insulation below 4" and 2" on sizes 4" and above.

I. On pipe sizes 4" and larger, fittings, mechanical couplings, and valves shall be insulated with molded fitting covers. Flanges shall be insulated with sectional pipe insulation extending a minimum of 1" beyond the end of the bolts. Bolt area shall be fitted with insulating and finishing cement.

3.2 GENERAL EXECUTION REQUIREMENTS - DUCTWORK:

A. Insulation shall be impaled over welded pins applied to duct surface on 12" to 18" centers. Use a minimum of two rows of fasteners on each side of duct. Secure insulation with suitable speed washers or clips firmly embedded into insulation.

B. All joints and voids in the insulation shall be filled with insulating and finishing cement. All joints and breaks in the vapor barrier shall be sealed with glass Fab and Benjamin Foster mastic to maintain vapour barrier. FSK/ASK tape is not allowed.

C. All standing seams and other projections shall have insulation applied so as to produce at least 1/2" cover.

3.3 GENERAL EXECUTION REQUIREMENTS - EQUIPMENT:

A. Insulation shall be firmly held in place with galvanized steel wire or galvanized steel bands on 12" centers.

END OF SECTION 23 07 00

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PART 1 - GENERAL:

1.1 SCOPE OF WORK:

A. Provide insulation as specified for condensate drain piping systems, including valves, mechanical coupling, fittings, flanges and strainers.

B. Equipment and components subject to heat transfer including:

1. Circuit Setter Foam Glass Covers
2. Other items where shown on drawings or as specified.

PART 2 - PRODUCTS:

2.1 PIPING INSULATION TYPES:

A. Type P-1 Pipe Insulation:

1. Insulation shall be UV resistant closed cell elastomeric with a K factor of .24 at 75 deg. F. mean temperature.

2. For fittings and valve bodies, insulation shall be cut and formed, seal all joints with proper adhesive. Close insulation to handle extension.

3. Insulation thickness schedule:

	Piping System	Thickness
a.	Condensate drains	½"

B. Equipment Insulation Types:

1. Type E-1 Equipment Insulation:

a. Insulation shall be ¾" thick closed cell elastomeric insulation having a maximum K factor of 0.24 at 75 deg. F. mean temperature.

PART 3 - EXECUTION:

3.1 PIPING INSULATION EXECUTION:

A. Type P-1 Insulation:

1. Form all insulation with minimal joints and cut sections. Form all fittings per manufacturer requirements.

2. All joints shall be sealed with manufacturer provided elastomeric adhesive and sealant.

3. All insulation installed outdoors shall be covered with embossed aluminum jacket secured at with minimum 3 bands per section and formed fittings.

3.2 EQUIPMENT INSULATION EXECUTION:

A. Type E-1:

1. Insulation shall be firmly held in place with galvanized steel wire or galvanized steel bands on 12" centers.

2. All joints and voids in the insulation shall be filled with adhesive and finishing cement.

END OF SECTION 23 07 02

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Provide insulation as specified for supply, return and outdoor air ductwork systems including accessories in mechanical rooms and for supply air systems in ceiling cavities. Where ductwork is specified to be lined, duct insulation will not be required.

1. Other items where shown on drawings or as specified.

B. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for correct fabrication and installation of fibrous glass duct liner in sheet metal ducts in accordance with applicable project drawings and specifications.

C. The finished duct system shall meet the requirements of NFPA 90A and 90B.

D. Dimensions shown on the plans are finished inside dimensions, allow for sheet metal increase as needed to maintain net free area.

E. Fabrication and installation shall conform to manufacturer's recommendations and to the requirements of the latest edition of North American Insulation Manufacturers Association (NAIMA) Fibrous Glass Duct Liner Standards, hereinafter referred to as NAIMA FGDLS, and/or Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Standard, HVAC Duct Construction Standards – Metal and Flexible, hereinafter referred to as SMACNA HVAC DCS.

F. Duct liner insulation materials shall meet the requirements of the following:

1. ASTM C 1071, Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
2. ASTM G 21, Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi (fungi resistance section only).
3. ASTM G 22, Practice for Determining Resistance of Plastics to Bacteria (bacteria resistance section only).

PART 2 - PRODUCTS:

2.1 DUCT INSULATION TYPES:

A. Type D-1 Insulation

1. Duct insulation shall be flexible 3/4 lb. per cubic foot density glass fiber with a minimum R value of 6 at 75 deg. F. mean temperature, with reinforced foil-faced, flame resistant Kraft vapor barrier. Provide Type D-1 for the following round, and concealed rectangular ductwork for all low pressure supply ductwork handling air from terminal unit discharge to diffusers, grilles and registers and all medium pressure ductwork from fan discharge to terminal units. Insulate all non-lined return air ductwork to ERV units only. Thickness 2". Ducts and casings containing all or a percentage of outside air on inlet side of air handling system. Thickness 2". Flexible duct runouts in supply air systems shall be furnished with factory installed insulation. Insulation shall have an R value of R-8 when wrapped on ductwork located in attic spaces.

B. Type D-2 Insulation:

1. Duct insulation shall be rigid 3lbs. per cubic foot density glass fiber with maximum K factor of .24 at 75 degrees F mean temperature with fire retardant vapor barrier facing. Provide type D-2 duct insulation on all exposed rectangular ducts and casings in mechanical rooms. Thicknesses shall be 2”.

C. Type D-3 Insulation:

1. Duct insulation shall be flexible 1 lb. per cubic foot density glass fiber with a minimum R value of 6 at 75 degrees F. mean temperature. Provide 2" thick type D-3 insulation on all rectangular ductwork and casings handling make-up air ductwork from make-up air unit to kitchen hood inlets.

D. Type D-4 Insulation:

1. Kitchen hood exhaust duct insulation shall be flexible “Thermal Ceramics Fire Master Duct Wrap”. 1-1/2" thick, 48" wide, R-value per ASTM C518: 4.5 per inch at 70°F, with a physical property of -280°F to +2300°F, with a melting point of 3200°F with a flame spread of 10 and smoke development of 5. Note: Two 1 ½" thick layers of blankets are required to meet UL classification.

2.2 INTERNAL DUCT LINER:

A. Duct Liner , for service at internal air velocities not to exceed 6,000 fpm (30.5 m/s): 1" thick. The duct liner shall be acoustical elastomeric liner similar to Armaflex “Coil-Flex” or K-Flex.

PART 3 - EXECUTION:

3.1 DUCT INSULATION:

A. Provide 0.016” thick aluminum jacket over all exterior ductwork. Pitch and lap to prevent standing water or water intrusion. Band as required.

B. Type D-1 Insulation:

1. Insulation shall be secured with Benjamin-Foster Mastic to preserve vapor barrier. All joints shall be sealed by stapling then adhering a 3" glass fabric strip at all joints and smooth finish coat of vapour Mastic coating. On rectangular duct, corner angles shall be used under tie wires to prevent cutting of vapor barrier.

C. Type D-2 Insulation:

1. Insulation shall be impaled over welded pins applied to duct surface on 12" to 18" centers. Use a minimum of two rows of fasteners on each side of duct. Secure insulation with suitable speed washers or clips firmly embedded into insulation. All joints and voids in the insulation shall be filled with Insulating and Finishing Cement. All joints and breaks in the vapor barrier shall be stapled, covered with 3” wide glass fabric and coated with one coat of Mastic sealant.

2. Exposed ductwork shall be finished by imbedding an open weave glass fabric (20 x 20) into the wet coating of Benjamin-Foster's 30-36, overlapping the seams at

least two inches. A finished coat of BF 30-36 shall then be applied. All outer corners of duct insulation shall be protected with Aljoin Tin Edges or equal before the finish is applied.

D. Type D-3 Insulation:

1. Insulation shall be secured with a 3” wide open weave glass cloth over joints and coating with BF 85-20. Butt all edges of insulation on round or flat-oval exposed ducts and lap all edges of insulation 2" on concealed ducts.

2. All exposed round or flat-oval ducts shall have a factory applied fire retardant vapor barrier facing and be finished by applying a presized glass cloth over the facing with Benjamin-Foster 85-20 adhesive.

E. Type D-4 Insulation:

1. Insulation shall be installed per manufacturer’s published recommendations.

END OF SECTION 23 07 06

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PART 1 - GENERAL:

1.1 SCOPE OF WORK:

A. Provide insulation as specified for hot water piping systems, including fittings.

1. Other items where shown on drawings or as specified.

PART 2 - PRODUCTS

2.1 PIPING INSULATION TYPES

A. Type P-3 Pipe Insulation:

1. Insulation shall be fire retardant close cell glass with a maximum K factor of 0.24 at 75°F mean temperature with factory applied Fire Retardant Jacket.

2. For fittings and valve bodies 3" and smaller, insulation shall be one-pound density glass fiber blanket wrapped firmly under compression with No. 20 gauge galvanized annealed steel wire and given a smoothing coat of finishing cement.

3. Insulation Thickness Schedule:

Piping System	Thickness
a. Refrigerant Hot gas	1 1/2"

PART 3 - EXECUTION

3.1 PIPING INSULATION EXECUTION

A. Longitudinal lap and 4" wide vapor barrier joint seal strips shall be adhered neatly in place with BF 85-20 adhesive or approved equal and banded.

B. The ends of pipe insulation shall be sealed off with BF 30-35 coatings at all flanges, valves and fittings and at intervals of not more than 21 feet on continuous runs of pipe.

END OF SECTION 23 07 08

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PART 1 - GENERAL

1.1 RELATED WORK:

A. Control Valves and Dampers; Refer to Section 23 09 01 - Control Valves and Dampers

B. Control Instrumentation; Refer to Section 23 09 02 - Control Instrumentation

C. Variable Frequency Motor Drives: Section 23 09 20

D. Control Sequences: Refer to Construction Drawings

E. Control Wiring Raceway and Installation: Shall conform to Division 26 – Electrical.

F. Control Wiring Conductors and Installation: Shall conform to Division 26 – Electrical.

1.2 REFERENCE:

A. The work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and Sections under Division 01 General Requirements.

1.3 SUMMARY:

A. Furnish all labor, materials, equipment and service necessary for a complete and operating Building Automation System (BAS), utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only.

B. All labor, material, equipment and software not specifically referred to herein or on the plans, that are required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.

1.4 SYSTEM DESCRIPTION:

A. The entire BAS system shall be comprised of a network of interoperable, stand-alone digital controllers and main building control panel communicating via LonMark/LonTalk and/or BACnet communication protocols to a Network Area Controller (NAC). Approved BAS contractor is Siemens Co. and shall be provided by Control Management Inc. of Charleston, South Carolina through existing district contacts.

1.5 SUBMITTAL:

A. Eight copies of shop drawings of the entire control system shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers catalog data sheets and installation instructions. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings. A complete written Sequence of Operation shall also be included with the submittal package.

B. Submittal shall also include a complete point list of all connected points to the DDC system.

1.6 DIVISION OF WORK:

A. The BAS contractor shall be responsible for all controllers (IDC and IBC), control devices, control panels, controller programming, controller programming software, controller input/output and power wiring and controller network wiring.

B. The BAS contractor shall be responsible for the Network Area Controller(s) (NAC), software and programming of the NAC, graphical user interface software (GUI), development of all graphical screens, setup of schedules logs and alarms, LonWorks network management, global supervisory control applications, system integration and coordination and connection of the NAC to the local or wide area network.

1.7 RELATED WORK SPECIFIED ELSEWHERE:

A. Division 26, Electrical:

B. Refer to Section 23 01 04.

1.8 AGENCY AND CODE APPROVALS:

A. All products of the BAS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided with the submittal package. Systems or products not currently offering the following approvals are not acceptable.

1. UL0916; Energy Management Systems
2. ULC; UL - Canadian Standards Association
3. FCC, part 15, Subpart J, Class A Computing Devices

1.9 SOFTWARE LICENSE AGREEMENT:

A. The Owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.

1.10 DELIVERY, STORAGE AND HANDLING:

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.11 JOB CONDITIONS:

A. Cooperation with Other Trades: Coordinate the work of this section with that of other sections to insure that the work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

1.12 QUALITY ASSURANCE:

A. The manufacturer of the BAS digital controllers shall provide documentation supporting compliance with ISO-9001 (Model for Quality Assurance in Design/Development,

Production, Installation and Servicing). Product literature provided by the BAS digital controller manufacturer shall contain the ISO-9001 Certification Mark from the applicable registrar.

1.13 SPECIFICATION NOMENCLATURE:

A. Acronyms used in this specification are as follows:

1.	CAS	Campus Automation System
2.	BAS	Building Automation System
3.	NAC	Network Area Controller
4.	IDC	Interoperable Digital Controller
5.	IBC	Interoperable BACnet Controller
6.	GUI	Graphical User Interface
7.	WBI	Web Browser Interface
8.	POT	Portable Operator's Terminal
9.	PMI	Power Measurement Interface
10.	DDC	Direct Digital Controls
11.	LAN	Local Area Network
12.	WAN	Wide Area Network
13.	OOT	Object Oriented Technology
14.	PICS	Product Interoperability Compliance Statement

PART 2 - PRODUCTS

2.1 GENERAL:

A. The Building Automation System (BAS) shall be comprised of a network of interoperable, stand-alone digital controllers, Owner's work station and other devices as specified herein.

2.2 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES:

A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate both the ANSI/ASHRAE Standard 135-1995 BACnet and LonWorks technology communication protocols. The system architecture shall consist of Network Access Controller (NAC), Building Control Unit (BCU/NCU), Interoperable Digital Controller (IBC/IDC), and field devices and sensors.

2.3 NETWORK ACCESS CONTROLLER (NAC)

A. The NAC shall reside on the Owner's IT network and uses standard internet protocol and technology. The NAC shall allow user to access the BAS using standard web browser. The NAC shall have SSL encryption and allow for multiple level password and user access. The NAC shall communicate with the building control unit and allow user to schedule, alarm, trend, view graphics, control I/O as defined in the points lists. Lost of the NAC shall not impaired the BAS from operating independently and function in a standalone mode.

2.4 BUILDING CONTROL UNIT (BCU/NCU)

A. The building control unit shall also reside on the Owner's IT network. The building control unit shall communicate with the NAC using standard BACnet IP protocol and bacnet objects. The building control unit shall communicate with the DDC controllers using

LonWorks or BACnet standard. The building controller shall have sufficient memory to support its operating system, database, and programming requirements. The operating system of the building controller shall manage the input and output communications signals to allow distributed unit controllers to share real and virtual point information and allow central monitoring and alarms. The building controller shall be capable of coordinating all BAS function in case of the loss of the NAC.

2.5 INTEROPERABLE DIGITAL CONTROLLER (IDC):

A. Controls shall be microprocessor based Interoperable LonMark™ or LonWorks Controls (IDC). Where possible, all Interoperable Digital Controllers shall bear the applicable LonMark™ interoperability logo on each product delivered.

B. HVAC control shall be accomplished using LonMark™ based devices where the application has a LonMark profile defined. Where LonMark devices are not available for a particular application, devices based on LonWorks shall be acceptable. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file for the device. Publicly available specifications for the Applications Programming Interface (API) must be provided for each LonWorks/LonMark controller defining the programming or setup of each device. The BAS contractor shall provide all programming, documentation and programming tools necessary to set up and configure the supplied devices per the specified sequences of operation.

C. The BAS contractor shall run the LonWorks network trunk to the nearest Network Area Controller (NAC). Coordinate locations of the NAC with the Owner's Information Technology staff to ensure that maximum network wiring distances, as specified by the LonWorks wiring guidelines, are not exceeded. A maximum of 120 devices may occupy any one LonWorks trunk and must be installed using the appropriate trunk termination device. All LonWorks and LonMark devices must be supplied using FTT-10A LonWorks communications transceivers.

D. The Network Area Controller (NAC) and building control unit (BCU), supplied by the BAS contractor, will provide all scheduling, alarming, trending, and network management for the LonMark/LonWorks based devices.

E. The IDC's shall communicate with the NAC at a baud rate of not less than 78.8K baud. The IDC shall provide LED indication of communication and controller performance to the technician, without cover removal.

F. All IDC's shall be fully application programmable and shall at all times maintain their LONMARK certification, if so certified. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the IDC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.

G. The Division 23 contractor supplying the IDC's shall provide documentation for each device, with the following information at a minimum:

1. Network Variable Inputs (nvi's); name and type
2. Network Variable Outputs (nvo's); name and type
3. Network configuration parameters (nci, nco); name and type

H. It is the responsibility of the Division 23 contractor to ensure that the proper Network Variable Inputs and Outputs (nvi and nvo) are provided in each IDC, as required by the point charts.

I. The supplier of any programmable IDC shall provide one copy of the manufacturer's programming tool, with documentation, to the owner.

2.6 INTEROPERABLE BACnet CONTROLLER (IBC)

A. Controls shall be microprocessor based Interoperable BACnet Controllers (IBC) in accordance with the ANSI/ASHRAE Standard 135-1995. IBCs shall be provided for Air Handling Units, Fan Coils, Pumps, Variable Air Volume (VAV) Terminals and other applications as shown on the drawings. The application control program shall be resident within the same enclosure as the input/output circuitry, which translates the sensor signals. The system supplier must provide a PICS document showing the installed systems compliance level to the ANSI/ASHRAE standard 135-1995, to the BAS contractor. Minimum compliance is Level 3.

B. The IBCs shall communicate with the NAC via an Ethernet connection at a baud rate of not less than 10 Mbps.

C. The IBC Sensor shall connect directly to the IBC and shall not utilize any of the I/O points of the controller. The IBC Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive. The IBC Sensor shall provide a communications jack for connection to the BACnet communication trunk to which the IBC controller is connected. The IBC Sensor, the connected controller, and all other devices on the BACnet bus shall be accessibly by the POT.

D. All IBCs shall be fully application programmable and shall at all times maintain their BACnet Level 3 compliance. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the IBC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.

E. The BAS contractor supplying the IBC's shall provide documentation for each device, with the following information at a minimum:

1. BACnet Device; MAC address, name, type and instance number
2. BACnet Objects; name, type and instance number

F. It is the responsibility of the Division 23 contractor to ensure that the proper BACnet objects are provided in each IBC, as required by the point charts.

2.7 OTHER CONTROL SYSTEM HARDWARE:

A. Wall Mount Room Thermostats: Each room thermostat shall provide temperature indication to the digital controller, provide the capability for a software-limited set point adjustment and operation override capability. An integral LCD shall annunciate current room temperature and set point as well as override status indication. In addition, the thermostat shall include a port for connection of the portable operator's terminal described elsewhere in this specification.

B. Duct Mount, Pipe Mount and Outside Air Temperature Sensors: 10,000-ohm thermistor temperature sensors with an accuracy of ±0.2 deg C. Outside air sensors shall include an integral sun shield.

C. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point.

D. Power Monitoring Interface: The Power Measurement Interface (PMI) device shall include the appropriate current and potential (voltage) transformers. The PMI shall be certified under UL-3111. The PMI shall perform continuous true RMS measurement based on 32 samples-per-cycle sampling on all voltage and current signals. The PMI shall provide outputs to the BAS based on the measurement and calculation of the following parameters: (a) current for each phase and average of all three phases, (b) kW for each phase and total of all three phases, (c) power factor for each phase and all three phases, (d) percent voltage unbalanced and (e) percent current unbalance. These output values shall be hard-wired inputs to the BAS or shall be communicated to the BAS over the open-protocol LAN.

E. Water Flow Meters: Water flow meters shall be axial turbine style flow meters which translate liquid motion into electronic output signals proportional to the flow sensed. Flow sensing turbine rotors shall be non-metallic and not impaired by magnetic drag. Flow metes shall be 'insertion' type complete with 'hot-tap' isolation valves to enable sensor removal without water supply system shutdown. Accuracy shall be ±2% of actual reading from 0.4 to 20 feet per second flow velocities.

F. Temperature Control Panels: Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. All electrical devices within a control panel shall be factory wired. Al external wiring shall be connected to terminal strips mounted within the panel. A complete set of 'as-built' control drawings (relating to the controls within that panel) shall be furnished within each control panel.

G. Thermostat and Temperature Controllers: Devices shall be line or low voltage type compatible with the function and sequence described under Sequence of Control. Proportioning thermostats shall have a bimetal element and shall be mounted on a bake-a-lite base. Thermostat shall include a proportioning rebalance magnet and shall have a 1 degree differential with a 4 degree throttle range. Contacts shall be rated for 1 amp at 24 volts AC. Covers shall be die cast aluminum and shall be completely blank providing for internal adjustment only.

H. Control Wiring: Minimum size for power conductors shall be No. 12 AWG Type TW solid and minimum size for control conductors shall be No. 14 AWG Type TW solid or No. 16 AWG Type TW stranded. Where conductors are to run to items for equipment containing electric heat or otherwise radiating excessive temperatures, 90 degrees Centigrade minimum conductor insulation shall be used, equal to type THHN-THWN with the exception of the mechanical room, all conduit shall be concealed. All electrical work shall comply with Division 26 of these specifications. Cable shall be routed in rigid galvanized conduit where located outside, below grade or in unconditioned spaces. Cable shall be routed in galvanized EMT conduit where installed in walls, above ceiling and all other locations not listed. Plenum rated cable shall be utilized only to make final connection to terminal units when absolutely necessary.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work and in the regular employment of the temperature control system manufacturer or its exclusive factory authorized installing contracting field office (representative). The installing office shall have a minimum of five years of installation experience with the manufacturer and shall provide documentation in submittal package verifying longevity of the installing company's relationship with the manufacturer. Supervision, calibration and checkout of the system shall be by the employees of the local exclusive factory authorized temperature control contracting field office (branch or representative).

B. Install system and materials in accordance with manufacturer's instructions, and as detailed o the project drawing set.

C. Drawings of temperature control systems are diagrammatic only and any apparatus not shown, such as relays, accessories, etc. but required to make the system operative to the complete satisfaction of the Architect shall be furnished and installed without additional cost.

D. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the BAS contractor in accordance with these specifications.

E. Equipment furnished by the HVAC Contractor that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field will be furnished and installed by the BAS contractor.

F. All control devices mounted on the face of control panels shall be clearly identified as to function and system served with permanently engraved phenolic labels.

3.2 COORDINATION

A. The BAS contractor shall coordinate with the Division 26 contractors to insure that all programmable objects, points and NVI/NVO, schedules and alarms etc. are available and software exposed so they may be interfaced from the Network Area Controller to provide functionality from the host system as desired by the owner. Any programming required to expose the programmable objects shall be done at the expense of the BAS contractor.

3.3 WIRING

A. All electrical control wiring and power wiring to the control panels shall be the responsibility of the BAS contractor.

B. The electrical contractor (Division 26) shall furnish power wiring for certain equipment and control panels in accordance with Section 230104 and as shown on electrical drawings. Any additional power wiring required by BAS work shall be provided under BAS from available Division 26 – Electrical gear equipment.

C. All power wiring shall be in accordance with the Project Electrical Specifications (Division 26), the National Electrical Code and any applicable local codes. All BAS wiring shall be installed in the conduit specified in the Project Electrical Specifications (Division 26).

D. Control wiring shall in accordance with National Electric Code. Final connection points at devices and panels shall be made at terminal blocks either integral to device or separate terminal blocks mounted inside of control panel enclosures.

E. For Signal Conductors (24 volts and under) no wire smaller than #18 AWG shall be used, except for manufacturer supplied instrument specific devices, or unless otherwise specified. Use 2 wire twisted pair 24 VDC for analog and/or discrete devices. For RTD signal wiring, use #18 AWG stranded, tinned copper twisted/shielded three conductor. Conductors not concealed in raceway shall have UL listed plenum rated Teflon insulation. Communication Cable: Minimum #18 twisted, shielded pairs, coaxial cable, fiber optics for communications between remote control devices. Provide 250 ohm, 5 watt, 0.1% tolerance dropping resistors as required to get 1 to 5 volt signals in 24 VDC powered loops. Provide isolated instrument grounding system as per manufacturer's recommendations.

F. Transient Voltage Surge Suppression Devices shall be designed for 120-volt power conditions devices for electronic equipment. Devices shall be designed, manufactured, tested and installed in compliance with ANSI/IEEE C62.41 and C62.45, Federal Information Processing Standards Publication 94 (FIPS PUB 94), NEMA NFPA 70, 75 and 78 and UL 1449 and 1283. Devices must be labeled for UL 1449. Clamping voltage for 120-volt power systems to be 400 volts. Provide visual indicator of when surge device has been used.

G. All control devices mounted on the face of control panels shall be clearly identified as to function and system served with permanently engraved phenolic labels.

3.4 WARRANTY

A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.

B. Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by the BAS contractor at no expense to the Owner.

3.5 WARRANTY ACCESS

A. The Owner shall grant to the BAS contractor, reasonable access to the BAS during the warranty period.

3.6 VAV COMMISSIONING

A. Auto-Commission Mode – Through the building control unit (BCU/NCU) the system operator shall have the ability to activate auto-commission feature of VAV controller. Auto-commission shall validate the proper operation of all outputs and have the ability to measure all inputs. The system operator shall be able to initiate a single VAV or multiple VAVs to auto-commission mode. The result of the auto-commission sequence is stored locally in the memory of the VAV controller and shall be accessible for viewing and printing from the BAS computer workstation. Auto-commission shall verify air flow at 40%, 100%, zone temperature, date/time, box number, fan, heat output and VAV discharge temperature (for VAV with fan and reheat).

3.7 AUTO CALIBRATION

A. Through the building control unit (BCU/NCU) the system operator shall have the ability to activate auto calibration feature of VAV controller. In the calibration mode, the system shall automatically recalibrate its air flow sensing & air valve position measurement system at system startup and on a scheduled basis.

3.8 ACCEPTANCE TESTING

A. The BAS contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications. The BAS contractor are to coordinate the checkout of the system such that each Division has a representative present during system checkout.

B. The BAS contractor shall perform tests to verify proper performance of components, routines and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.

C. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

D. System Acceptance: Satisfactory completion is when the BAS contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.9 O&M MANUALS

A. Upon completion of the work, provide 8 copies of O&M Manuals which are to include the following:

1. All system manuals including operation, catalog, installation and troubleshooting documents.

2. Programming and application manuals for controllers.

3. Recommended maintenance procedures for each of the system devices.

4. A list of all equipment vendor(s) including name, address, phone number and contact as well as equipment purchased from each.

5. Eight copies of the 'as-built' drawings shall be provided in addition to the documents on magnetic disk media or compact disk.

B. Controlled Equipment: Furnish, install, connect and place into operation control equipment and devices to provide the sequence of operation specified in the following paragraphs.

1. See "Sequences of Operation" on the drawings.
2. See "Points List" on the drawings.

3.10 OTHER CONTROL SYSTEM HARDWARE

A. Wall Mount Room Thermostats: Each room thermostat shall provide temperature indication to the digital controller, provide the capability for a software-limited set point

adjustment and operation override capability. An integral LCD shall annunciate current room temperature and set point as well as override status indication. In addition, the thermostat shall include a port for connection of the portable operator's terminal described elsewhere in this specification.

B. Duct Mount, Pipe Mount and Outside Air Temperature Sensors: 10,000-ohm thermistor temperature sensors with an accuracy of ± 0.2ºC. Outside air sensors shall include an integral sun shield.

C. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point.

D. Power Monitoring Interface: The Power Measurement Interface (PMI) device shall include the appropriate current and potential (voltage) transformers. The PMI shall be certified under UL-3111. The PMI shall perform continuous true RMS measurement based on 32 samples-per-cycle sampling on all voltage and current signals. The PMI shall provide outputs to the BAS based on the measurement and calculation of the following parameters: (a) current for each phase and average of all three phases, (b) kW for each phase and total of all three phases, (c) power factor for each phase and all three phases, (d) percent voltage unbalance and (e) percent current unbalance. These output values shall be hard-wired inputs to the BAS or shall be communicated to the BAS over the open-protocol LAN.

E. Local control panels shall be constructed of steel or extruded aluminum with hinged door and keyed lock, with baked enamel finish of manufacturer's standard color. Construction shall comply with NEMA 1 standards for interior panels, NEMA 4 for exterior panels.

F. Controlling instruments, temperature indicators, relays, switches and gauges shall be factory installed and permanently labeled. Devices shall be located inside or mounted on face of panel.

G. Unless otherwise indicated, mount control and adjusting switches, temperature indicators, and other indicating or manually operated devices, on front face of panel with black phenolic engraved nameplates.

3.11 GENERAL:

A. Install all control equipment and wiring in neat and workmanlike manner to satisfaction of Engineer.

B. Coordinate timely delivery of materials and supervise activities of other trade contractors to install devices such as immersion wells, pressure tappings, any associated shut-off valves, flow switches, level switches, flow meters, valves, dampers and other such items furnished by BAS contractor which are to be installed by Mechanical Contractor.

C. Install control devices in accessible location.

D. Coordinate mounting height and location of control devices so the NEC workspace clearances are maintained.

3.12 OWNER TRAINING:

A. Provide BAS operator to run systems after systems have been started and are regularly

used until Owner has completed on site training specified.

B. Conduct training sessions during normal business hours after system start-up and acceptance by Owner. Scheduling of training session(s) will be established by Owner. Portions of training may be performed before system is completely operational, but no sooner than one month before system is planned to be fully operational. Final training sessions shall be held after systems are complete.

C. Owner training shall be executed in three phases. The BAS contractor will provide at no cost to the owner Phase I, Phase II, and Phase III training classes. Travel expenses will be the responsibility of the owner.

D. The first phase shall take place at the customer job site and will be scheduled at a time preceding owner acceptance. The purpose of the training is to provide an introduction and an overview of the BAS.

E. The second phase of training shall be a follow-up training to address specific questions of the operators. Training shall take place at the customer job site and will, at a minimum, include a site-specific walk through and hands on site-specific instruction. Completion of this training shall be a condition of system acceptance and the commencement of the Warrantee Period.

F. The third phase of training shall be provided off site at the BAS software manufacturer's Training Facilities as a follow-up and enrichment to the introductory and site-specific training. A proposed training agenda will be submitted to the owner's Facility Mechanical Engineer in writing, and approved by the Facility Mechanical Engineer before the training takes place. All materials shall be supplied for three trainees to be selected by the owner.

3.13 PHASE I - ON SITE TRAINING:

A. Prior to beginning training, provide 2 copies of operator's manuals.

B. This training will give the operator with little or no experience with the BAS an introduction to:

1. Building automation fundamentals
2. System architecture and functions as they pertain to the site
3. System access using the Browser User Interface and BAS software
4. Basic software controller programming
5. Editing parameters such as set points and schedules
6. Day to day system monitoring
7. The complete range of hardware and software products

C. This phase of training shall be a minimum of 4 hours.

3.14 PHASE II - ON SITE TRAINING:

A. Site personnel and operators shall become familiar and proficient with:

1. Using As-Built documentation, Sequences of operation, control drawings, input/output summaries
2. Field sensor and actuator location and maintenance
3. Field controller location and maintenance
4. BAS hardware operation and maintenance

5. BAS software site specific capabilities

B. This phase of training shall be a minimum of 4 hours.

3.15 PHASE III - OFFSITE TRAINING:

A. Facility representative will become qualified using hands-on labs for:

1. Networking and Internet Basics
2. Technology Overview and System Architecture
3. Installation and Start-Up
4. Configuring Standard Control Objects
5. Global Control Functions
6. Designing and Building Web Interface Solutions
7. Database Services
8. Managing Security
9. Engineering Views, Troubleshooting Tools

B. This phase of training shall be a minimum of 4 hours.

C. Provide a minimum of 8 hours of additional on-site training to Owner's Representatives, six months after initial training is completed.

D. Owner will establish the schedule of training session(s).

END OF SECTION 23 09 00

PART 1 - GENERAL

1.1 RELATED WORK:

A. REFERENCE: The work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 - General Requirements.

1.2 SUBMITTALS:

A. Product data sheets shall include construction materials and assembly methods, maximum design parameters (temperature, pressure, velocity, etc.) and performance data for full range of actuator stroke. Product data sheets shall include all charts, graphics, or similar items used in making selections including damper to duct area ratio and free area ration. Damper product sheets shall indicate certified leakage rates for given pressure differential.

B. Submit valve schedules with shop drawings which indicate unique tag numbers for each device, equipment or system served, device model numbers, sizes, shutoff head required, actuator air pressure or force required to meet shutoff head, torque requirements for rotary valves, flow coefficients (Cv) for 20% and 100% valve stem travel, actual flow requirements based on equipment shop drawings, calculation of actual pressure drops actuator model number, actuator torque capacities and pilot positioner locations.

C. Valve and damper shop drawing submittals will not be processed unless all supporting data and flow coefficients are included.

1.3 VALVE SELECTION AND SIZING:

A. Select control valves to meet their intended service without cavitation. Provide cavitation calculations for modulating butterfly valves over 60 degrees F.

B. Valve body ratings indicated in Part 2 are minimum required. Valve body, trim and packing selected shall be designed to withstand maximum pressure and temperature encountered in the systems.

C. Water Valves: Select control valves based on pressure drop calculations on Cv values at 100% stroke and Cv values at 20% stroke as scheduled.

1.4 DAMPER SELECTION AND SIZING:

A. Provide dampers as shown on drawings or as scheduled.

B. Two position dampers to be sized as close as possible to duct size, but in no case is damper size to be less than duct area.

C. Submit leakage and flow characteristics data for all control dampers along with shop drawings. Leakage ratings to be based on AMCA Standard 500 and dampers to bear AMCA Air Leakage Seals.

PART 2 - PRODUCTS:

2.1 CONTROL DAMPERS:

A. If control damper sizes are not shown or scheduled, refer to Part 1 of this Section for sizing criteria.

B. Two position (open/close) dampers shall be parallel blade type.

C. All blade linkage hardware shall have corrosion-resistant finish and be readily accessible for maintenance.

D. Standard Two Position Dampers:

1. Johnson Controls D-1200/D-1300 (Double Piece)
2. Honeywell D642/D643
3. Ruskin CD50/CD60

E. Damper frames shall be minimum of 16 gauge galvanized steel or 14 gauge extruded aluminum. Blades shall be minimum of 16 gauge galvanized steel or 14 gauge aluminum. Blades shall have maximum blade width of 8" with steel trunnions mounted in bronze sleeve, nylon or ball bearings.

F. Furnish dampers with blade seal and stainless steel side seals. Dampers and seals shall be suitable for maximum system temperatures, pressure differential and approach velocity, but not less than temperature range of -40F to 200F, pressure differential of 6" wg, and approach velocity of 4000 FPM.

G. Dampers when closed, shall be guaranteed by control manufacturer not to leak air in excess of 100 CFM at 4" wg static pressure for 48" x 48" damper size (6.25 CFM per ft.²).

H. Maximum blade width of 8" with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.

I. Provide low leakage control dampers where not furnished with packaged units. Damper leakage rate shall not exceed 10 cfm/sq. ft. at 4" wg.. Dampers shall have blade seals and stops. The shaft to which the actuator(s) is coupled shall be square of hexagonal or round with one side flattened, to achieve secure coupling.

J. Provide DDC actuators for all automatic control dampers. Locate damper actuators outside of the air stream. Positioning relays will be provided for each damper section: one each for outside air, return air and relief air.

K. Control dampers used for outside air or exhaust shall be installed a minimum of 6" away from wall penetrations to allow for external mounting of actuators.

L. Throttling operation shall be opposed blade type.

M. Floating point or step control not allowed.

2.2 DAMPER AND VALVE ACTUATORS:

A. DDC Diaphragm with Spring Return: Actuators shall be same manufacturer as valve body and shall be selected to match maximum diaphragm air pressure, fail position, stroke, shutoff pressure, temperature, torque, etc., required for intended service. Unless otherwise scheduled, diaphragm air pressure shall be enough to provide 100% valve shutoff at least equal to pump shutoff head or 125% or rated flow head for water systems. Select spring ranges to match intended service. If valves or dampers are sequenced, spring ranges shall not overlap.

B. Pilot Positioners: Provide pilot positioners with mechanical feedback of actual actuator position. Pilot positioners may use 4-20 mA electronic input signal with full range 3-15 psi pneumatic output. Input ranges and gain factors shall be fully field adjustable.

PART 3 - EXECUTION

3.1 CONTROL VALVES:

A. Furnish control valves as shown on drawings and/or as required to perform control sequence specified.

B. Control valves furnished by BAS Contractor will be installed by Mechanical Contractor under coordinating control and supervision of BAS Contractor.

C. Increaser and decreaser fittings required to facilitate valves will be provided by Mechanical Contractor.

3.2 CONTROL DAMPERS:

A. Furnish control dampers as shown on drawings and/or as required to perform control sequence specified except those furnished with other equipment.

B. Control dampers furnished by Control Contractor will be installed by Mechanical Contractor under coordinating control and supervision of Control Contractor.

C. Blank-off plates or transitions required to facilitate dampers will be provided by Mechanical Contractor.

3.3 ACTUATORS AND PILOT POSITIONERS:

A. Provide actuator for each automatic damper or valve with sufficient capacity to operate damper or valve under all conditions. Select actuators to provide tight shut off against maximum system temperatures and pressure encountered. Each actuator shall be full-proportioning or two-position type as required or specified, and shall be provided with spring-return for fail open or fail closed position for fire, freeze, occupant safety, equipment protection, moisture, heating or cooling protection on power interruption as indicated and/or as required.

B. Where sequencing of valves or dampers is required for pneumatic systems, such sequencing shall be accomplished by spring ranges adequate for applications to avoid overlap of operation and simultaneous use of heating and cooling.

C. Provide pilot positioners for modulating valves.

D. Provide pilot positioners for all sequenced devices, and devices which require adjustable operating speeds.

E. Valve and damper operating speeds shall be selected or adjusted so operators will remain in step with controller without hunting regardless of load variations. Operators acting in sequence with other operators shall have adjustment of control sequence as required by operating characteristics of system.

F. Provide proper linkage and brackets for mounting and attaching actuators to devices. Design mounting and/or support to provide no more than 5% hysteresis in either direction

(actual movement of valve steam/damper shaft/deal movement) due to deflection of actuator mounting.

G. Calibrate position feedback potentiometers where specified with range and gain factors as required for proper operation per manufacturer's recommendations.

END OF SECTION 23 09 01

PART 1 - GENERAL

1.1 RELATED WORK:

A. Control Systems Integration:

1. Refer to Section 23 09 00 - Control Systems Integration.

1.2 REFERENCE:

A. The work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 - General Requirements.

1.3 SUBMITTALS:

A. Devices shall be indexed by bill of material for each system as detailed in Section 23 09 00 - Control Systems Integration.

1.4 FCC COMPLIANCE:

A. Digital equipment furnished under this contract shall have been tested and made to comply with the limits for a Class A computing device pursuant to Subpart J of part 15 of FCC Rules, which are designed for provide reasonable protection against interference when operated in commercial environment. Literature shall so note and all equipment shall be so labeled.

PART 2 - PRODUCTS:

2.1 GENERAL

A. Device pressure and temperature ratings indicated in Part 2 are minimum required. All devices shall be designed to withstand maximum pressure and temperature encountered in the system.

2.2 GENERAL INSTRUMENTATION:

A. Pressure Gauges:

1. Ashcroft, Ametek, Trerice, Weksler.

2. Air pressure indicating gauges to be at least 1 ½" diameter. Gauge faces to be marked with range of unit being controlled.

3. Pressure gauges used for panel mounted indicators shall be marked in appropriate units and with appropriate range of values. Panel mounted indicators shall be minimum 3 ½" in diameter and have accuracy of 1% of scale range.

4. Furnish pressure gauges with tappings for piping.

2.3 DISCRETE ELECTRIC INSTRUMENTATION:

A. Electrical devices, switches, and relays shall be UL listed and of the type meeting current and voltage characteristics of the project. Terminal connections shall be made at terminal blocks inside of NEMA 1 enclosures unless otherwise specified.

B. Ratings of normally open and closed contacts shall be adequate for applied load (minimum 5 amps at 240 volts).

C. Accuracy of devices shall be ± 1% of scale with adjustable offset unless otherwise specified.

D. Relays:

1. IDEC, Potter Brumfield, Square D, or Allen Bradley.

2. Equal to IDEC type RH2B-U, miniature 8 blade pilot relay with DPDT silver cadmium oxide contacts rated at 15A, 30 VDC, or 120 VAC. Coil shall match control circuit characteristics. DDC outputs shall be 24 VDC with maximum current burden of 50 milliamps. Rectangular base socket mount with blade type plug-in terminals and polycarbonate dust cover.

3. Provide DIN rail mountable (Snap type) mounting sockets equal to IDEC SH2B-05.

E. Pressure Differential Switches:

1. Allen Bradley, Ashcroft, Barber-Colman, Dwyer, Honeywell, Johnson Controls, Landis Gyr Powers, Penn, Robertshaw, SOR, United Electric.

2. Adjustable set point, differential pressure type. Select switches for accuracy, ranges (20 to 80% of operating range) and dead-band to match process conditions, electrical requirements and to implement intended functions.

3. Pressure differential switches shall be provided with totally sealed vapor tight switch enclosure on 300 psi body. Differential pressure switches to have 3-valve manifold for servicing.

4. Maximum Temperature Rating: 300F

5. Repeatability: ±1%

F. Target Type (Paddle) Flow Switches:

1. Honeywell, Johnson Controls, Kobold, McDonnell & Miller, or SOR.

2. Adjustable setpoint, paddle type. Select switches for accuracy and ranges to match process conditions and electrical requirements to implement intended functions.

3. Furnish water sensing switches with NPT fittings suitable for pipeline mounting. Switches shall be rated for 300 psi.

G. Liquid Level Switches:

1. Magnetrol or approved equal, equal to Magnetrol Model T20-1.

2. Switch to be a mercury switch rated for 10A at 120 VAC. Switch housing shall be suitable for submersible application. Switch shall have one normally open and one normally closed contact.

3. Float and trim shall be stainless steel. Tank connection size to be 1" NPT, with 3" x 5" float size.

H. Position Switches (End Switches):

1. Allen Bradley, GE, Johnson Controls, Honeywell, Square D, Westinghouse, or Westlock.

2. Provide valve position switches, toggle switches as required to meet specified sequence. Rotary switches shall be cam action, lever, or proximity type.

I. Current Switches:

1. Allen Bradley, GE, Kele, Nellsen-Kuijan, Square D, or Westinghouse.

2. Induction type sensor clamped over a single phase of AC electrical power conductor shall be a solid state sensor with adjustable threshold and normally open contacts. Each current switch shall be selected for proper operating range of current.

3. Transition Current: 75 mA to 1 A setpoint / 2.5 at 10 A setpoint

4. Hysteresis: 0.015 A at 1 A setpoint / 0.20 A at 10 A setpoint

5. Response Time: less than 0.5 seconds

J. Local Control Panel Alarm Horns:

1. Honeywell, Johnson Controls, Landis Gyr Power, Panalarm, Siebe Environmental Controls (Barber Colman/Robertshaw), or Ronan.

2. 24 volt alarm horn suitable for panel mounting.

K. Indicator Lights:

1. Allen Bradley, GE, Square D, or Westinghouse.

2. 1/4" minimum size, push-to-test type. Use green for normal, yellow for warning (low/high values), and red for alarm or fail (low-low or high-high conditions). AC or DC type with voltage matched to control circuit without transformers.

2.4 ANALOG ELECTRONIC INSTRUMENTATION:

A. Space Temperature Sensors: Sensors shall be platinum RTD type, with the following minimum performance. Provide wall mount per Owner preference.

1. Temperature Coefficient of Resistivity (TCR): .00385 ohm/ohm/°C

2. Accuracy: ± 0.1% at 32°F (Class B)

3. Conformance: DIN-IEC 751

4. Operating Range: -50 to 500°F / 0 to 99% RH

B. Insertion Temperature Sensors and Transmitters: Nickel RTD type, with the following minimum performance:

1. Temperature Coefficient of Resistivity (TCR): .00385 ohm/ohm/°C

2. Accuracy: ± 0.12% at 32°F (Class B)

3. Conformance: DIN-IEC 751

4. Operating Range: -50 to 170°F / 0 to 99% RH

C. Transmitters shall be Moore Products, Rosemont or SMAR. Transmitter shall provide two wire 4-20 ma current output proportional to specified temperature span of sensor and compatible with DDC equipment. Power supply shall be 13-35 VDC unregulated and accuracy to be 0.1% of span of sensor and transmitter combination.

D. Industrial Grade Pressure/Differential Pressure Transmitter:

1. Fischer & Porter, Foxboro, Moore Products, Rosemount, Bailey, Foxboro, ITT Barton, Honeywell, Johnson Yokogawa.

2. Pressure sensor and integral 4-20 mA VDC transmitter. Select instrument for intended usage (differential pressure, gauge pressure, level, etc.), range, maximum pressure/temperature. Sensor shall be capacitance or stain gauge type. Enclosure to be NEMA 4.

3. Differential pressure transmitters shall have 3-valve manifold for servicing.

4. Diaphragm Material: Stainless Steel or Hastelloy

5. Process Connection: " NPT Stainless Steel

6. Power Supply Voltage: 13 - 35 VDC unregulated

7. Over Pressure: 1000 psig or 2 times maximum operating pressure whichever is greater.

8. Performance:

a. Zero: Zero control shall be continuously adjustable between -50% and 100% of upper range limit. Total calibrated span and zero adjustment cannot exceed upper range limit. Zero span shall be independently field adjustable with no interaction.

b. Accuracy: ±0.25% of calibrated span, including the effects of linearity, hysteresis, repeatability dead band.

c. Drift: ±0.1% of upper limit for 6 months.

d. Power Supply Effect: Less than 0.01% of output span per volt.

e. Static Pressure Effect: Zero Error: ±0.1% of upper range limit per 1000 psi.

f. Span Error: ±0.2% of reading per 1000 psi.

g. Both the sensor and the analyzer/transmitter shall be of same manufacturer. Vendor and contractor shall ensure that both instruments are of compatible types.

h. Installation: Immersion/Submersion

i. Maximum Operating Temperature: 110°C

j. Maximum Operating Pressure: 250 psig at rated temperature

k. Process connection: 3/4" Male NPT

l. Wetted Parts: Polyproplene

2.5 DIFFERENTIAL PRESSURE FLOW ELEMENT: PITOT TUBE:

A. Manufacturer: Dieterich Standard, Preso, or approved equal.

B. The flow element shall be averaging pitot differential pressure type. Flow element shall consist of three parts: a fabricated sensing tube with two internal chambers. Both chambers shall have an array of impact ports whose quantity and size are a function of pipe line size.

C. Accuracy: ±1.0%

D. Repeatability: 0.5%

E. Mounting Hardware: Coupling and Nipple, Carbon Steel

F. Sensor Materials of Construction: Stainless Steel

G. Insertion Connection: Insert/Retract “Hot Tap” including insertion device and isolation ball valve

H. Instruction Valves: Ball

I. Packing Gland: Urethane

J. Flow element shall be diamond or elliptical in shape.

K. CO2 SENSOR: Provide wall mount or insertion type sensors as required. Wall mount shall be flat face without display.

L. Humidity sensor: Provide wall mount or insertion type sensors as required. Wall mount shall be flat face without display. Integral wall mount temp/humidity sensors are acceptable.

PART 3 - EXECUTION

3.1 GENERAL:

A. Install control equipment, wiring and air piping in neat and workmanlike manner to satisfaction of Engineer, and in accordance with manufacturer's recommendations. Maintain clearances, straight length distances, etc. required for proper operation of each device. Mark and detail exact location of inline devices, wells, and taps to be installed by Mechanical Contractor on coordination drawings.

B. Coordinate timely delivery of materials and supervise activities of other trade contractors to install inline devices such as immersion wells, pressure tappings, any associated shut-off valves, flow switches, level switches, flow meters, air flow stations, and other such items furnished by Control Contractor which are to be installed by Mechanical Contractor.

C. Install control devices in accessible location.

D. Mount motor control devices within 5 feet of disconnect switch, or starting device furnished by Electrical Contractor unless noted otherwise. Maintain required NEC clearances.

3.2 GENERAL INSTRUMENTATION:

A. Pressure Gauges (Pressure Indicators):

1. Install pressure gauge for indication of supply and control pressure in pneumatic systems at output of controllers, I/P transducers, electric air solenoid valves and pressure switches and other points where visible indication of air pressure is required for operating and maintenance purposes.

2. Provide test port for quick connection of test gauges at valve, damper motor and other actuators branch lines.

3. Pressure gauge tappings in piping will be installed by Mechanical Contractor.

3.3 LOCAL CONTROL PANELS:

A. Install remote mounted devices, controllers, I/O terminal blocks, power supplies, etc. inside of local control panels.

B. Locate panels as shown on drawings.

C. Mount top of panel between 5 and 6 feet above floor so that gauges and indicators are at eye level.

3.4 DISCRETE AND ANALOG INSTRUMENTATION:

A. Space Temperature Sensors:

1. Install space sensors where indicated, as required to perform specified controls, or directed to meet job site conditions.

2. Mount sensors 5-0" above floor unless otherwise indicated.

B. Water Flow Meters and Flow Switches:

1. Install flow measuring devices with recommended straight pipe diameters upstream and downstream of elbows, tees, valves, or other fittings which cause uneven turbulent flow conditions.

2. If no recommendations are given, provide straight pipe equal to 10 pipe diameters upstream and 5 pipe diameters downstream.

C. Sensor Wells:

1. Install sensor wells for all temperature sensor/transmitters. Wells mounted in pipe 3" and larger may be installed in horizontal or vertical lines provided element is always in the flow (for gravity return lines, install in bottom of pipe). Wells mounted in pipe 2 ½" and smaller shall be installed at elbow tee fittings with well pointed upstream. Minimum of 2" pipe size for elbow tee installation.

D. Transmitters and Indicators:

1. Locate transmitters in accessible location on wall within 100 feet of sensor. For indicating type instruments, locate indicating element with 6 feet of the floor with readout easily visible from floor level. Provide remote readouts if necessary.

E. Liquid Level Switches:

1. Locate switch to sense level in the cooling tower sump. Provide 3/8" thick galvanized steel mounting plate with 1" NPT threaded tapping for mounting level switch. Fasten mounting plate to concrete sump wall and cooling tower. Install switch enclosure above the normal tower water level.

END OF SECTION 23 09 02

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PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. This work shall consist of furnishing all labor, materials, equipment and services necessary for the installation of all equipment specified hereinafter. All drives for this building shall be manufactured by one manufacturer.

B. Equipment and components relevant to this section include:

1. Variable frequency motor drives.

C. Warranty:

1. Parts and Labor 36 Month Warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 VARIABLE FREQUENCY MOTOR DRIVES:

A. This contractor shall install variable frequency motor drive for each of the supply and return fan motors as shown on drawings. The drives shall be manufactured by ABB, Danfoss or Siemens in all equipment. No exceptions.

B. The AC inverter shall have a six step output and a diode bridge front end with a chopper circuit to ensure a 0.95 power factor and low noise. The unit shall have a 460 volt, 3-phase, 60 HZ input. All devices shall be furnished and installed in the drive package and warranted by the drive manufacturer.

C. The unit shall include the following as standard:

1. NEMA 1 enclosure, unless otherwise stated on drawings
2. Input power disconnect switch - lockable
3. Input fuses
4. Motor overload relay
5. Motor soft start feature
6. 4-20 MA current follower
7. Min/Max speed adjustments (for fan protection)
8. Adjustable current limit
9. Over temperature protection
10. Under/over voltage protection
11. Short circuit protection
12. Manual restart circuit to restart drive after a power outage or power dip.

D. The unit shall also include as standard the following controls/indicators mounted and wired on the enclosure door.

1. Manual/off/automatic mode selector switch
2. Speed potentiometer for manual control
3. Power on pilot light

4. Drive trip pilot light
5. Manual bypass

PART 3 - EXECUTION

3.1 VARIABLE FREQUENCY MOTOR DRIVES:

A. Units shall be installed in strict accordance with the manufacturer's recommendations and the approved shop drawings.

B. Factory start-up and check-out shall be provided by the drive manufacturer.

END OF SECTION 23 09 20

PART 1 - GENERAL:

1.1 SCOPE OF WORK:

A. This work shall consist of furnishing all labor, material, equipment and services necessary for the installation of all equipment specified hereinafter.

B. Systems, piping and components principally relevant to this section include:

1. Condensate drain piping and fittings.
2. Other items where shown on the drawings or as specified.

PART 2 - PRODUCTS:

2.1 CONDENSATE DRAIN PIPING AND FITTINGS:

A. Pipe material shall be type "L" hard drawn copper tubing with 125 psi solder joint wrought copper fittings, domestically manufactured in the United States. Foreign and imported piping will not be considered by this owner.

B. Fittings for copper pipe shall be wrought copper, or cast brass.

C. Slope drain pipe 1/8” per foot in the direction of flow.

2.2 REFRIGERANT PIPING AND FITTINGS

A. Piping: Copper tubing ASTM B280, Type ACR hard drawn

B. Fittings: ANSI/ASTM B16.22 wrought copper.

C. Joints: ANSI/ASTM B32, solder grade 95 TA.

D. Provide liquid filter drier, sight glasses, service valves, solenoid valves, and other specialties as required for proper operation of the complete system.

E. Sight glasses shall have metal screw-on protective cap.

2.3 COMPOUNDS, SOLDER AND LEAD:

A. Pipe Thread Compound:

1. Crane, Dixon, Rutland, or equal, or Teflon tape type.

B. Solder-joint: Solder joints in copper pipe shall be made with 95% tin, 5% antimony solder up to and including 1¼” pipe. Use brazing solder for joints in pipes above 1¼”. Use 95-5 at valves.

PART 3 - EXECUTION:

3.1 GENERAL:

A. For purposes of clarity and legibility, the contract documents are essentially diagrammatic and, although size and location of piping are drawn to scale wherever possible, HVAC contractor shall make use of all data in all of the contract documents and shall verify this information at building site.

B. The contract documents indicate required size and points of termination of pipes and suggest proper routes of piping to conform to structure, avoid obstructions and preserve clearances. However, it is not intended that the contract documents indicate all necessary offsets, and it shall be the work of this section to install piping in such a manner as to conform to structure, avoid obstructions, preserve headroom and keep openings and passageways clear, without further instructions or cost to the Owner. The contractor shall fully inform himself regarding any and all peculiarities and limitations of the spaces available for the installation of all work and materials furnished and installed under the contract. He shall exercise due and particular caution to determine that all parts of his work are made quickly and easily accessible. Although the locations of the equipment and piping may be shown on the contract documents in certain positions, the contractor shall be guided by the architectural details and conditions existing at the job, correlating this work with that of others. Provide all offsets as required to produce a neat, workmanlike arrangement.

C. The HVAC contractor shall study all drawings and specifications to determine any conflict with ordinances and statutes. Likewise, any errors or omissions shall be reported prior to bidding. Any changes shall be shown in drawings made by this contractor, and any additional work shall be performed at no additional cost to the Owner.

D. Submittal of bid shall indicate the contractor has examined the site and contract documents and has included all required allowances in his bid. No allowance shall be made for any error resulting from contractor's failure to visit job sites and to review contract documents and bid shall include costs for all required drawings and changes as outlined above, all at no additional cost to the Owner.

E. All piping shall be installed to prevent unusual noise from the flow of water under normal conditions. Insert one (1) inch strip of hair felt to isolate all piping from any direct contact with any part of the building, framing, conduit, etc.

F. Springing, bending or forcing of pipe will not be allowed. Use fittings for all offsets or changes in alignment of piping. Center hubs so cast iron or clay pipe will lay straight without pinched joints.

G. All changes in directions shall be made with approved fittings. Mitering, saddling or welding of smaller pipe and larger piping is prohibited.

H. Pipe openings shall be closed with caps or plugs during installation. Rags and tin cans are not considered suitable closures.

I. Damage by leaks - The HVAC contractor shall be responsible for damage to the grounds, walks, road, buildings, pipe systems, electrical systems and their equipment and contents, caused by leaks in the piping system being installed or having been installed herein. He shall repair at his expense all damage so caused. All repair work shall be performed as directed by the Architect.

J. The use of chemicals or so-called "Stop-Leak" compounds will not be permitted at any time.

K. Unions shall be provided at connection to all equipment.

L. Escutcheon plates shall be provided at all exposed penetrations of walls, ceilings, floors, etc.

M. Bypass Piping: Except as otherwise indicated, fabricate and install bypass piping using same materials and in same plane as connected piping, but one pipe size smaller. Include valve in bypass piping. Install bypass piping around control valves, PRV stations and as shown on drawings.

N. Drain Valves: Install on each mechanical equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain hot/chilled water piping system.

3.2 PIPE JOINING METHODS:

A. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.

B. Braze copper tube-and-fitting joints where indicated, in accordance with ANSI B31.1. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

C. Screwed piping shall conform to the following:

1. Pipe Nipples: Any piece of pipe 3" in length or less shall be considered a nipple. All nipples with unthreaded portion 1-1/2" and less shall be extra heavy. Only shoulder nipples shall be used. No close nipples will be provided.

2. Screw threads shall be cut clean and true: screw joints made tight without caulking. No caulking will be permitted. A non-hardening lubricant will be used. No bushings shall be used. Reductions, otherwise causing objectionable water or air pockets, to be made with eccentric reducers or eccentric fittings. All pipe shall be reamed out after cutting to remove all burrs.

3.3 REFRIGERANT PIPING

A. Install refrigeration specialties in accordance with manufacturer’s instructions. Route piping in orderly manner, parallel to building structure and maintain gradient. Install piping to conserve building space. Do not interfere with the service requirements of equipment. Group piping wherever practical at common elevations and locations. Slope piping one percent in the direction of oil return.

B. Provide non-conducting dielectric connections when joining dissimilar metals. Install piping to allow for expansion and contraction without stressing piping, joints or connected equipment.

C. Provide clearance for installation and access to valve and fittings.

D. Provide insulation on all piping. Provide aluminum jacket on all outdoor piping.

E. Fully charge complete system with refrigerant after testing.

F. Test refrigeration system in accordance with ANSI/ASME B31.5.

1. Pressure test system with dry nitrogen to 200 psig. Perform final tests at 27" vacuum and 200 psig using electronic leak detector. Test to no leakage.

END OF SECTION 23 21 13

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This work consists of providing all labor, materials, equipment, and services necessary for the installation of all sheet metal work and related equipment and accessories as indicated on the drawings, required and/or as specified.

1.2 STANDARDS:

A. All ductwork installation including hangers, supports, access doors, etc. shall be in accordance with the latest recommendations of the ASHRAE Guide, the SMACNA High (medium) Pressure Duct Construction Standards, SMACNA Low Pressure Duct Construction Standards, SMACNA Duct Liner Application Standard, and with details on the drawings.

1.3 QUALIFICATION OF MEDIUM VELOCITY DUCT SUPPLIER:

A. The round and flat oval medium pressure ductwork and fittings, as shown on the plans, shall be manufactured by a company who has had as its principal business the manufacture of medium pressure duct and fittings for at least three years.

B. This Contractor shall submit with his proposed list of equipment manufacturers the name of the manufacturer of the medium pressure ductwork.

1.4 GENERAL REQUIREMENTS:

A. Provide all metal ductwork as indicated on the drawings. Ducts, unless otherwise specified shall be constructed entirely of galvanized steel sheets. Where specified or indicated on drawings, ducts shall have duct lining installed on the inside of the ducts. The duct dimensions indicated on the drawings are the net air stream dimensions. Add to the sheetmetal dimensions to allow for the duct liner.

B. All sheet metal work shall be performed by trained mechanics, experienced in this type of work and shall be installed in a neat workmanlike and substantial manner.

C. All duct joints sealing compounds, glues, mastics, and adhesives used on duct construction shall be "Fire Safe" and be "U.L." approved and labeled.

D. In all cases where duct sleeves are roughed through walls, floors, or ceilings, they shall be blocked and braced to prevent sagging or crushing occurring during construction. Ducts passing through floors of above ground equipment rooms shall have concrete curbs and flashing to prevent leaking to water around duct openings. Duct openings through exposed wall of equipment room shall be fitted with sheet metal collars to make a neat closure between opening and sleeve.

E. The general location of ducts shall be as shown. Exact location of ductwork into proper relation with other equipment features of the building.

F. Material shall be prime galvanized sheet steel free from blisters or other mechanical defects.

G. Shop fabricate ductwork in 4, 8, 10 or 12-foot lengths, unless otherwise indicated or required to complete runs. Pre-assemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for re-assembly and coordinated installation.

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS:

A. Exposed ductwork materials: Where ductwork is indicated to be exposed to view in occupied spaces, vertical chases and equipment rooms, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains and discolorations, and other imperfections, including those which would impair painting.

B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ANSI/ASTM A 527, lockforming quality, with ANSI/ASTM A 525, G90 zinc coating; mill phosphatized for exposed locations.

C. Stainless Steel Sheet: Where indicated, provide stainless steel complying with ANSI/ASTM A167; AISI Type 302/304/316 with No. 4 directional polish where exposed to view in occupied spaces. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

2.2 LOW PRESSURE DUCTWORK:

A. Ductwork shall be designed for velocities not exceeding 2000 FPM or static pressures not exceeding 2 inches.

B. Sheet metal gauges, cross joints and reinforcing shall be as indicated on Table 1 of SMACNA.

C. The Pittsburg lock shall be used for longitudinal seams and shall conform to Plate No. 5A of SMACNA.

D. Elbows shall be square with double thickness turning vanes and shall conform to Plate No. 22 of SMACNA.

E. Tapers and offsets shall conform to Plate No. 23 of SMACNA.

F. Where changes are made in shape of ducts full areas shall be maintained and changes shall be gradual to minimize pressure drop.

G. Ducts terminating at grilles and registers shall be provided with suitable means of attachment.

H. Air cushions shall be provided beyond the last take off on a duct run at least equal to the depth of the duct at that point.

I. Obstructions in ductwork shall be streamlined and shall conform to Plate no. 24 of SMACNA.

J. Branch round ducts should enter main using spin-in steel fittings with balancing damper by Genflex.

2.3 KITCHEN HOOD EXHAUST DUCTWORK:

A. Ductwork shall be constructed of #16 gauge welded black steel.

2.4 DRYER EXHAUST DUCTWORK:

A. Ductwork shall be 20 gauge G80 steel with no longitudinal joints on bottom of ductwork. All joints shall be sealed water and moisture tight. No screw penetrations through duct.

2.5 MEDIUM PRESSURE DUCTWORK:

A. Ductwork shall be designed for velocities in excess of 2000 FPM and static pressure from 2" W.G. static pressure to 6" W.G. static pressure not to exceed 6" W.G. static pressure.

B. This contractor shall not provide additional bends, takeoffs, offsets or changes in shape without prior approval of engineer.

C. Air cushions shall be provided beyond the last takeoff on a duct run at least equal to the depth of the duct at that point.

D. Zinc coatings burnt off of steel during welding, shall be painted to prevent corrosion at the weld.

2.6 RECTANGULAR MEDIUM PRESSURE DUCTWORK:

A. Sheet metal gauges, cross joints, and reinforcing shall be as indicated on Figure 3-1 of SMACNA.

B. Joints selected shall be constructed in accordance with figures 3-4 thru 3-15. Sealant shall be applied at all joints.

C. The rods shall be fastened in accordance with Figures 3-18 and 3-20 of SMACNA.

D. Fasteners shall be in accordance with Figure 3-19 of SMACNA.

E. Radiused elbows shall be provided with splitters and shall be in accordance with Figures 3-21 and 3-22 of SMACNA.

F. Square throat elbows with turning vanes shall be in accordance with Figure 3-23 of SMACNA.

G. Transformations shall be full area type in accordance with Figures 3-24 thru 3-27 of SMACNA.

H. Branch connection shall be in accordance with Figure 3-28 of SMACNA.

I. Obstructions in ductwork shall not be allowed.

2.7 CIRCULAR MEDIUM PRESSURE DUCTS:

A. All medium pressure circular ducts and fittings shall be manufactured by the same firm to assure tight fit of all ductwork and components.

B. Submittals shall include manufacturer's data on materials and accessories for medium pressure ducts and fittings.

C. The fittings shall be manufactured to published standards for dimensions and construction details. Installation manuals shall be supplied to the contractor to provide detailed instructions on: Assembly, Joint Sealing, System Pressure Testing and Leaks, and reinforcement of ducts.

D. The fitting test data shall cover the friction loss tests of die-stamped elbows in diameters 3" through 8", 5-piece gored elbows in diameters 9" through 80", reducers, and divided flow fittings of Tee, Lateral, and Conical types, plus the coefficients of abrupt turn fittings including Y-branch, Bullhead Tee, Capped Cross, Cushion Head Cross, and Mitered Elbow Fittings. The friction loss characteristics of divided flow fittings combined with elbows for cross-over connections, as detailed in plans, are to be included in this submittal.

E. The spiral pipe shall have locked seams so made as to eliminate any leakage under the pressures for which this system has been designed. Longitudinal seam duct shall have a fusion welded butt seam. Pipe, fittings and couplings shall be of the following minimum gauges per SMACNA Standards.

F. All fittings are to have continuous welds along all seams. All divided flow fittings are to be manufactured as separate fittings, not as tap collars welded into spiral duct sections. All 90 degree tees and 45 degree laterals (wyes) up to and including 12" diameter tap size shall have a radius entrance into the tap, produced by machine or press forming. The entrance shall be free of weld buildup, burrs, or irregularities.

G. Elbows in diameters 3" through 8" shall be two section stamped elbows. All other elbows shall be gored construction with all seams continuous-welded. Elbows shall be fabricated to a center-line radius 1.5 times the cross-section diameter. All elbows, not die-stamped shall be fabricated according to the following schedule:

	Elbow Angle	**Number of Gores**
1.	Less than 30 degree	2
2.	30 degree thru 60 degree	3
3.	Over 60 degree	5

H. Where it is necessary to use 2-piece mitered elbows, they shall have turning vanes in accordance with the following schedule:

	Diameter	Number of Vanes
1.	3" thru 9"	2
2.	10" thru 14"	3
3.	15" thru 19"	4
4.	20" and Over	5

I. The leading edge of all vanes in ducts over 20" diameter shall be hemmed with ½" fold-back. Turning vanes in ducts over 24" shall be reinforced by rods or sectional construction to limit unsupported length to 24". Vanes shall be minimum of 20 gauge.

J. The reduction of divided flow fittings shall be conical spun section in the thirty-six common reductions in sizes 4" through 22".

K. Spun bellmouth connections are to be used at each round take-off from the high pressure plenum.

L. Galvanized areas that have been damaged by welding shall be coated with corrosion resistant aluminum paint.

2.8 COUPLINGS FOR ROUND MEDIUM PRESSURE DUCT:

A. Pipe-to-pipe joints in diameters to 50" are by the use of sleeve couplings, reinforced by rolled beads.

B. Pipe-to-fitting joints in diameters to 50" are by slip-fit of projecting collar of the fitting into the pipe.

C. Insertion length of sleeve coupling and fitting collar is 2" for diameters through 9" and 4" for diameters 10" and up. Pipe-to-pipe and pipe-to-fitting connections in diameters above 50" are made by angle ring flanges. Connections 51" and up are made by the loose ring "Van Stone" flange. A one-half inch flange is provided for the body ends of duct sections and fittings to act as a gasketing surface for sealing. The angle ring is rolled, welded ring 2" x 2" x 3/16".

D. Bolt hole spacing for angle rings shall not exceed 6".

E. If duct sections in diameters greater than 50" are supplied in lengths greater than 4' lengths, one angle ring must be welded to duct on 4' centers. Welding can be an intermittent weld of 1" and 4".

F. Girth reinforcing and girth joints shall be in accordance with Figure 2-2 of SMACNA.

G. Branch and take-off fittings shall be "conical tees" or "conical tee reducing" fittings.

H. Final connections to the individual terminal supply units shall be made by means of a flexible duct. All such ductwork shall have a Class "A" seal and shall be tested at 3.0" w.g. as outlined in SMACNA Manual for Balancing and Adjustment of Air Distribution Systems. Total leakage shall not exceed 1% of supply air fan design CFM.

I. Branch fittings and reducers shall be as indicated on plans and in accordance with Figures 2-5 and 2-6 of SMACNA.

J. Obstructions in ductwork shall not be allowed.

K. Transformation pieces at fans and attenuators shall be fabricated of not less than 18 gauge galvanized steel suitably braced.

L. Volume dampers shall be of the low pressure drop, balancing type.

2.9 FLEXIBLE DUCTWORK:

A. Insulated flexible duct shall be FlexMaster 8-M rated to 6" working pressure. The liner shall be as described for type 8-M incapsulating a spring steel helix. The liner shall completely shield the nominal 1" x 1 lb. per cu. ft. fiberglass insulation from the air stream. A tough seamless non-vinyl exterior vapor barrier jacket shall complete the assembly. It will be in compliance with the provisions of UL-181 Class 1 Air Duct Material.

B. Ductwork shall be a maximum of 6'-0" long and shall be provided with a flame resistant PVC vapor barrier and 1" thick, ¾" density fiberglass insulation.

C. Ductwork must comply with NFPA Bulletin 90A and be listed as a Class I connector per UL Standard 181.

2.10 FLEXIBLE EQUIPMENT CONNECTION:

A. All connections between equipment and ductwork shall be made with a flexible connection consisting of a heavy glass fabric, double coated with neoprene. Material shall withstand the air pressure, 250 deg. F. temperature continuously, be fire resistant, waterproof and airtight and shall be the product of Vent Fabrics, Inc. or equal.

2.11 DUCT LINER:

A. Liner shall be 1" thick, with a thermal conductivity of 0.23 BTU/Hr.Sq.Ft./deg. F./in at a mean temperature of 75 deg. F, , or approved equivalent.

B. Liner shall be smooth finish, air flow side with a SMACNA standard cleanable surface and Green Guard rated anti-microbial coating.

C. Adhesives shall conform to Adhesive and Sealant Council "Standards for Adhesives for Duct Liner" ASC-A-7001-1971.

D. Linings shall be designed for velocities not exceeding 2000 FPM.

2.12 DUCT SEALANT:

A. Non-hardening, non-migrating mastic or liquid elastic sealant (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.

2.13 DUCT CEMENT:

A. Non-hardening migrating mastic or liquid neoprene based cement (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.

2.14 CLOTHES DRYER EXHAUST DUCT:

A. Dryer exhaust ducts which are not designed for a specific dryer shall be constructed of minimum 0.0217 inch (0.551 mm) galvanized steel. The ducts shall have smooth interior finish with joints running in the direction of the air flow. The entire exhaust system shall be properly secured in place. Provide wall cap with damper for 4" vents and roof rain cap for commercial dryers.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCTWORK - GENERAL:

A. Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight (2% leakage) and noiseless (no objectional noise) systems, capable for performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling.

B. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct unusable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building. Limit clearances to ½" where furring is shown for enclosure of concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work. Do not locate ductwork over (parallel to) position indicated to extend to deck.

C. Electrical Equipment Spaces: Do not run ductwork through transformer vaults and their electrical equipment spaces and enclosures.

D. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus-insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1½".

E. Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

F. Support ductwork in manner complying with SMACNA "Low Pressure Duct Standards - 5th Edition" hangers and supports section.

3.2 DUCT HANGERS AND SUPPORTS:

A. Hangers and supports shall conform to the latest edition of SMACNA Standards Plates 16, 17, 18 and 19.

B. Hangers and supports for ductwork shall not support any other devices unless approved in writing by Engineer.

C. Hanger sizes for rectangular duct shall be as follows for 6 foot spacing.

	Longest Dimension of Duct	Round Hangers	Strap Hangers	Trapeze Shelf Angles
1.	Up thru 18"	8 Ga. Wire	1"x16 Ga	1"x1"x1/8"
2.	19" thru 30"	8 Ga. Wire	1"x16 Ga	1"x1"x1/8"
3.	31" thru 42"	1/4" Rod	1"x16 Ga	11/2"x1 1/2" x1/8"
4.	43" thru 60"	3/8" Rod	1"x16 Ga	11/2"x1 1/2" x1/8"

D. All ductwork shall be properly secured directly to the structure of the building using suitable strap or angle hangers. Hangers with a load of 50 pounds or less may be at the bottom chord panel points of bar joists. Hangers with larger loads must be hung from top chord of bar joists. C clamps are not to be used.

E. Risers within duct shaft shall be supported every 8 feet by angleclips.

3.3 DUCT CONSTRUCTION FOR LOW VELOCITY DUCTS:

A. All joints in supply duct work shall be sealed with an approved type duct sealing tape or sealing compound. Where pressure sensitive tape is used for sealing duct joints use an approved type tape sealer in addition to the adhesive on the tape. Joint sealer to be U.L. labeled and fire safe.

B. Changes in shape and dimension shall conform to the following:

1. For increases in cross-sectional area, the shape of the transformation shall not exceed 1" in 7".

2. For reductions in area, the slope may be 1" in 4", but 1" in 7" is preferred.

3. All changes in direction shall either be with a radius not less than 1/2 width of the duct, or square elbow (both) with turning vanes.

3.4 DUCT CONSTRUCTION FOR KITCHEN HOOD EXHAUST DUCTWORK:

A. Fabricate joints and seams with continuous welds for watertight construction. Provide for thermal expansion of ductwork through 2000 degree F temperature range. Install without dips or traps which may collect residues, except where traps have continuous or automatic residue removal. Provide access openings with door at each change in direction and every 15' length, located on sides of duct 1½” minimum from bottom, and fitted with greasetight covers of same material as duct.

B. Ductwork shall meet the requirements of N.F.P.A. 96.

C. Ductwork shall be provided with welded seams and 2" x 2" x 3/16" matched angle iron joint connections. All joints shall be ground smooth, fitted and bolted with asbestos gaskets to make connections airtight. The exterior of all kitchen range exhaust ducts shall have 1-1/2" x 1-1/2" x 1/8" welded angles, punched for securing insulation where specified.

3.5 DUCT CONSTRUCTION FOR DISHWASHER HOOD EXHAUST DUCTWORK:

A. Ductwork shall be evenly pitched back to dishwasher. All joints shall be sealed water and moisture tight with silicon sealant.

B. Wherever aluminum is in contact with concrete, the aluminum shall be cleaned and painted one coat of zinc chromate before erection.

3.6 DUCT CONSTRUCTION FOR MEDIUM PRESSURE RECTANGULAR DUCTWORK:

A. All high velocity ducts must have all seams, joints and connections with sealing compound of an approved type. Sealing compound to be liquid sealer or bead type sealer as required to meet the special conditions. All duct sealing compound of an approved type. Sealing compound to be liquid sealer or bead type sealer as required to meet the special conditions. All duct sealing compound must be fire safe and labeled.

B. Shop procedure for sealing ducts shall be as follows:

1. Before fittings and joints are assembled, duct sealer shall be applied to rivets, grooved seams and tap-off collars. On the internal side of the metal, Pittsburgh

lock, pocket shall be flooded with sealing compound using pump type oil can, and the duct assembled.

2. Duct sealer of an approved type shall be brushed around reinforcing rod washers, corners, rivets, notches and tap-off collars after duct is assembled. A double "S" slip or other approved type connectors shall be installed on the air leaving side of the duct and fastened in-place, using meal screws on 6 inch centers. Sealing compound shall be brushed into connecting lap and corner joints and all seams of "S" slip or approved type connector.

3. Coat inside of connecting lap of "S" slip and duct surface with sealing compound. Where possible sealing should be done on inside of the ductwork.

C. Field procedure for sealing joints shall be as follows:

1. Sealing compound shall be spread on the inside of the double "S" slip or connector and the joints of duct assembled. Immediately after joints are assembled, holes will be drilled through the "S" slip and metal screws inserted on 6 inch centers. Sealer shall be applied over the screw head.

2. After 24 hours, second coat of sealing compound shall be spread over the joints and allowed to dry for 24 hours before testing.

3. Where joints are not accessible for proper sealing, hand holes should be cut in the duct and the joints sealed from the inside. Special care shall be taken to seal off duct corner.

4. When testing ducts for leaks, leaks should be marked and sealed without pressure, using sealing compound and allowed to dry for 24 hours.

5. All branch take-offs taps to terminal units shall be conical fitting or as indicated on drawings. All perpendicular take-offs shall be made the bell-mouth tappings or fittings.

6. All square bends and elbows with a center line radius of turn less than 1-1/2 by the width of the duct shall be provided with "formed" turning vanes. These vanes shall be made of 20 gauge galvanized metal up to 18 inches in length and 18 gauge for over 18 inches length. Vanes shall be spaced on approximately 3 inch center. Vanes shall have "Runners" attached where shown on plans.

3.7 DUCT CONSTRUCTION FOR MEDIUM PRESSURE ROUND DUCTWORK:

A. Approved sealer Minnesota Mining EC-800 shall be applied to the male end of the couplings and fittings. After the joint is slipped together, sheet metal screws shall be placed ½" from the joint bead for mechanical strength. Sealer shall be applied to the outside of the joint extending one inch on each side of the joint bead and covering the screw heads. An approved tape shall be immediately applied over the wet sealer.

B. The duct sealer shall be specifically formulated for the job of sealing the field joints for high pressure system. The sealer shall be compatible with an approved type duct tape so the two shall cure and bond together.

C. Flanged joints shall be sealed by Neoprene Rubber gaskets.

D. All duct sealer shall be fire safe and shall be "U.L." approved for this use.

E. All exposed duct shall be dual wall with 1” internal duct.

3.8 FLEXIBLE DUCTWORK:

A. The installation shall conform to the techniques shown in the UL approved and factory supplied instructions specified for the product. Submittals will include product data sheets as well as approved installation instructions. Care is to be taken that all run-outs of flexible duct are installed as straight as practical and fastened so as to eliminate leakage and vibration.

B. Peel back jacket and insulation at end of flexible duct. Fit duct over collar or sleeve and clamps and seal as described for uninsulated flexible duct. Pull jacket and insulation back in place and secure with two wraps of duct tape.

C. Secure flexible duct to collar or sleeve with ½ inch wide aluminum galvanized steel or stainless steel bands or clamps and matching seals. Clamping device shall be two inches back from end of flexible duct. Seal with two wraps of duct tape Polyhen #222, Arno #C-520 or Nashua No. 357.

3.9 DUCT LINER:

A. Sound absorbing lining shall be secured to the ducts by a complete covering coat of adhesive and mechanical fasteners 12 inch on centers.

B. For horizontal runs when the duct width or height exceeds 20", the liner shall be additionally secured with fasteners starting within 3" of the upstream transverse edges of the duct liner boards and be spaced at a maximum of 15" O.C. and 15" from the longitudinal joints. On vertical runs, the fasteners shall be used when either dimension exceeds 12".

C. All butt edges of the lining shall be joined with a suitable factory adhesive. Coated side shall be toward air stream. That portion of ducts that are lined shall be increased in size equal to the thickness of the lining. Duct sizes shown on the plans are net inside dimensions with lining in place.

D. Provide liner in transfer return air traps and in return grille boots.

E. All abutting edges of duct linings shall be sealed and all exposed edges of linings shall be installed with a sheet metal nosing.

3.10 CLEANING AND PROTECTION:

A. Clean ductwork internally, unit-by-unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

B. Strip protective paper from stainless steel ductwork surfaces, and repair finish wherever it has been damaged.

C. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

D. Temporary Cooling or Heat: Provide MERV 8, roll type filter media at “all” return air inlets to ERV, RTU and heat pumps if systems are to be used during finishing work phase of construction. Remove prior to occupancy and replace with scheduled type of MERV 13 final filters.

END OF SECTION 23 31 13

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PART 1 - GENERAL

1.1 GENERAL

A. This work consists of furnishing all labor, materials, equipment, and services necessary for the installation of sound attenuators for the heating, cooling, and ventilating system as indicated on the drawings, required, and as specified. Contractor shall submit shop drawings for the attenuators including size, velocity, pressure drop and acoustic performance.

PART 2 - PRODUCTS

2.1 SOUND ATTENUATOR:

A. Provide attenuators where indicated on the drawings and schedule. Units shall be manufactured by IAC, Gale, Keene, Vibro-Acoustics or approved equal.

B. The shell of the attenuator shall be at least 22 gauge galvanized steel and shall be leak-proof when subjected to a differential pressure of 8" W.G.

C. Sound absorbing material shall be protected from erosion by means of a 24 gauge galvanized steel perforated sheet (sheet galvanized after punching).

D. Sound absorbing material shall be incombustible, vermin proof, waterproof, inorganic, impart no odor to the air and shall have a flame spread rating of 25 or less, and a smoke developed rating of 50 or less.

E. The pressure drop shall not be greater than shown on the schedule. Should the pressure drop (after installation) be greater than specified or scheduled, the contractor shall replace the units and/or modify the entrance or discharge aerodynamic flow to achieve the specified results. All corrective costs shall be born by this contractor.

F. Acoustic and aerodynamic performance shall be determined in an independent test laboratory. It shall be tested for insertion loss with or without air flow in accordance with ASTM E477-73. Insertion loss shall not be less than scheduled on an approach velocity of air flow. Acoustic rating shall include Dynamic Insertion Loss (DIL) and Self-Noise (SN), Power level both for forward flow (air and noise in the same direction). Sound power level DB re 10-12 watt. Self noise (SN) shall be measured according to ASHRAE 36-72.

G. Certification: The manufacturer shall supply with submittals certified test data on Dynamic Insertion Loss, Self-Noise Power Levels, and Aerodynamic Performance for Reverse and Forward Flow test conditions. Test data shall be for a standard product. All rating tests shall be conducted in the same facility, shall utilize the same attenuator and shall be open to inspection upon request from the Architect/Engineer.

PART 3 - EXECUTION:

3.1 GENERAL

A. Install as recommended by the attenuator manufacturer.

END OF SECTION 23 32 00

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. This work consists of furnishing all labor, materials, equipment, and services necessary for the installation of all supply, return, ventilation, and exhaust ductwork accessories and related equipment and accessories as indicated on the drawings, required, and as specified.

B. Accessories by Ruskin, Nailor, Indeeco are acceptable.

PART 2 - PRODUCTS

2.1 LOUVERS:

A. All louvers shall be provided by the General Contractor. This contractor shall make all connections thereto and install 18 gauge dual wall insulated blank-off sheets as required and/or indicated on the drawings for blank off of unused portion of louver.

2.2 INSTRUMENT TEST HOLES:

A. Provide test holes Ventlok 699-2 or approved equal complete with gasket and heavy screw cap.

2.3 FIRE DAMPERS:

A. Damper blades shall be housed outside of the air stream and shall not restrict the air flow, and be Type-B construction.

B. Fire dampers shall be UL listed.

C. For each fire damper provide a collar of the following gauge.

	Width or Height Maximum Dimension	**Minimum Metal Gauge**
1.	Up to 36"	16
2.	Over 36"	14

D. Dampers shall be of the integrally hinged, folding plate curtain type.

E. Dampers shall be compatible with firewalls, partitions or ducts within which they are to be installed and shall be complete with 160□F fusible link and link retainer.

F. Where dampers are installed in vertical airflow positions, they shall be provided with vertical stainless steel closure springs and cam type blade locks. The locking device shall be so designed as to permit dampers to be reset easily without being removed from the partitions in which they are resolved.

2.4 COMBINATION FIRE/SMOKE DAMPERS:

A. Each damper shall be static type airfoil blade UL555S leakage class I, 1½ hour rated, 16ga frame with double skin blade at 14 ga equivalent, maximum 6" wide blade.
B. Provide each damper with fast acting 24V controller actuator, with end switch feedback to BAS and wall sleeve.
C. Model shall be Ruskin model FSD60-BAL (or pre-approved equal) with no more than 0.15" pressure drop, fully opened at 1750 feet-per-minute on a 48"x12" damper size.

2.5 DUCT ACCESS PANELS:

A. Provide hinged access doors, Ruskin ADH24-HP or approved equal near each damper and smoke detector.

B. Door frame shall be pre-insulated internally with 1" thick 1-1/2# coated fiberglass in a 24 gauge galvanized steel casing and a 24 gauge galvanized door frame.

C. Frame shall be provided with a foam gasket seal between frame and duct and between frame and door.

D. Hinged door shall be locked with a cam lock latch.

E. For medium pressure applications, access panels shall be hinged to implode.

F. Access doors shall be a minimum of 12" x 12". Label access door for the use it is installed.

2.6 MANUAL DAMPERS:

A. Volume dampers shall be manually operated, single or multi-blade type with sleeve bearings, galvanized steel interlocking blades and a galvanized steel frame. In ducts over 12 inches deep use multiple opposed blade type, gang operated dampers with a maximum blade width of 8 inches. Fabricate damper blades of 16 gauge steel with hemmed edges, and a maximum length of 48 inches. Damper operating rod shall be full blade length extended through the duct to externally mounted bearing plates. All insulated ductwork bearing plates shall be flush with insulation finish and fastened to the duct; operating lever shall be of the indicating type with locking quadrant.

B. Furnish and install, where indicated on the drawings or where required, air splitter dampers and/or butterfly dampers with indicating and locking quadrants or push rods and pillow blocks. The dampers shall be two gauges heavier than the ducts in which they are installed. Damper blades shall be riveted to the supporting rod. Splitter dampers shall be sufficiently long to extend the full width of the branch duct to which attached. Where necessary they shall be curved to scoop branch duct air out of the main duct air stream.

C. Splitter dampers shall also be designed to conform to Figure A of Plate No. 28 of the SMACNA Low Velocity Duct Construction Standards.

D. Dampers up to 48" x 12" shall be single blade designed to conform to Figures B, C and D, Plate No. 28 of the SMACNA Low Velocity Duct Construction Standards.

E. Dampers with blade lengths over 48" shall be made in multiple sections with mullions between the sections of blades.

F. Dampers in duct over 12" height shall be multibladed and designed to conform to Figures B and C of Plate No. 29 of the SMACNA Low Velocity Duct Construction standards.

2.7 TURNING VANES:

A. All square elbows shall be provided with airfoil shaped turning vanes for noise and directional control.

B. Vanes shall be installed in accordance with Plate No. 22 of the SMACNA Low Velocity Duct Construction standards.

C. Vane runners shall be screwed to the vanes; runner assembly shall be spot welded, riveted or screwed to duct sides.

2.8 GRAVITY BACKDRAFT DAMPERS:

A. Provide gravity backdraft dampers as indicated on drawings complete with frame. Frame shall be of galvanized steel channel construction with corner braces. Damper shall consist of 14 gauge aluminum blades with polyurethane foam edges. Axles shall be of zinc plated steel construction operating in ball bearings.

B. Blades shall be counterbalanced and field adjustable for a range of .01 to .25 inches static pressure.

C. Assembly shall be Ruskin Type CBD-4 or approved equal.

2.9 AIR MONITOR STATION:

A. Each device shall be designed and built to comply with, and provide results in accordance with accepted practice as defined for system testing in the ASHRAE Handbook of Fundamentals as well as the Industrial Ventilation Handbook.

B. Airflow measuring stations shall be fabricated of heavy gauge galvanized steel welded casing with 90 deg. connecting flanges in a configuration and size equal to that of the duct it is mounted into. Each station shall be complete with an air directionalizer and parallel cell profile suppressor across the entering airstream and mechanically fastened to the casing, equal-area and equal-weighted averaging total pressure sensors and manifold, internal piping, and external pressure transmitter ports. An identification label shall be placed on each unit casing listing model number, size, area, and specified airflow capacity.

C. Static sensing stations used for sensing the supply (or return) air distribution system static pressure shall be fabricated in accordance with that outlined for airflow measuring stations except that multiple bullet-nose shaped static pressure sensors with averaging manifold shall be furnished in lieu of the total pressure sensors and manifold.

D. Where multiple stations serve a common fan or fan plenum, coordinate with the temperature control contractor all necessary electronic control devices (velocity pressure transmitters, square root extractors, multipliers, and arithmetic relays) to sum or total the station airflow rates for CFM readout and control signal use.

E. Where the capacities of un-monitored fans must be used in the resetting of airflow control CFM or CFM setpoints, provide a programmer capable of receiving electric or pneumatic signals indicating the operating status of the fans and developing a control reset signal

equivalent to the total air volume of the operating fans, regardless of the sequence of operation of the fans.

F. The maximum allowable pressure loss through the unit shall not exceed .065" w.g. at 1000 fpm, or .23" w.g. at 2000 fpm. Each unit shall be capable of measuring the airflow rate within an accuracy of 2% as determined by U.S. G.S.A. certification tests shall contain a minimum of one total pressure sensor per thirty-six square inches of unit measuring area.

G. The units shall have a self-generated sound rating of less than NC40, and the sound level within the duct shall not be amplified nor shall additional sound be generated.

H. Air monitors at fan inlet shall be Volu-probe type.

PART 3 - EXECUTION:

3.1 LOUVERS

A. All louvers shall be provided by the General Contractor. This Contractor shall make all connection thereto and install insulated dual wall blank-off as required.

3.2 INSTRUMENT TEST HOLES:

A. Test holes shall be provided at the following locations:

1. Each discharge duct from air handling units.

2. Each return duct to air handling units.

3. Each fresh air duct to air handling units.

4. Each discharge duct from the duct heating coils.

5. Each discharge duct from air terminal device.

3.3 FIRE DAMPERS:

A. Install fire dampers where indicated on plans/or as required by the State Fire Marshal or the local Fire Marshal as applicable.

B. Fire Damper testing Requirements: Prior to occupancy and in the presence of the Engineer, each fire damper shall be tested and shown to be operations.

C. Should any fire damper be found to be unacceptable and require an additional trip for the Engineer, said trip will be billed to the Contractor in accordance with the regents as defined in the general provisions of the specification.

3.4 COMBINATION FIRE/SMOKE DAMPERS:

A. Install dampers with sleeve, per manufacturer’s recommendation to meet IBC Code. All wiring between operator and air handling unit and BAS interlock shall be the controls sub-contractor’s responsibility. The fire alarm contractor will be responsible for the wiring and programming of smoke detectors into the fire alarm panel. Mechanical contractor will be

responsible for power wiring from an electrical panel or designated emergency junction box (refer to electrical plans for locations). All wiring shall be in conduit. Electrical contractor will furnish smoke detector for each damper. Installation of detector in duct by mechanical contractor.

3.5 DUCT ACCESS DOORS:

A. Access panels shall be located at the following installation:

1. All automatic dampers in ductwork.
2. All fire dampers.
3. Smoke detectors.
4. Combination fire/smoke dampers

3.6 MANUAL DAMPERS:

A. Dampers in exposed ductwork or ductwork accessible from lay-in tile ceilings shall be controlled with quadrants mount on duct walls.

B. Dampers in concealed ductwork or ductwork not accessible due to plaster ceilings, concealed spline ceilings, etc., shall be provided with an extension and quadrant handle in ceiling enclosed in a box with an enameled cover plate.

C. Volume dampers shall be located where shown on drawings and as required by the balancing sub-contractor.

3.7 TURNING VANES:

A. Vanes shall be installed in accordance with Plate No. 22 of the SMACNA Low Velocity Duct Construction standards.

B. Vane runners shall be screwed to the vanes, runner assembly shall be spot welded, riveted or screwed to duct sides.

3.8 AIR MONITOR STATIONS:

A. Stations shall be installed in strict accordance with the manufacturer's published requirements. These stations serve as the primary signals for the airflow control systems, therefore it shall be the responsibility of the contractor to verify location and installation to assure the accurate primary signals are obtained.

END OF SECTION 23 33 00

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PART 1 - GENERAL:

1.1 SCOPE OF WORK:

A. This work consists of providing all labor, materials, equipment, and services necessary for the installation of exhaust fans for the heating, cooling, and ventilation systems as indicated on the drawings, required, and as specified.

1.2 SUBMITTALS:

A. Shop drawings, product data, assembly drawings, wiring diagrams, performance, maintenance data, etc. shall be submitted in accordance with the provisions of specification Section 23 01 00.

PART 2 - PRODUCTS:

2.1 CENTRIFUGAL CABINET EXHAUST FANS:

A. Duct mounted exhaust or return fans shall be of the centrifugal, belt driven in-line type. The fan housing shall be of the rectangular design constructed of heavy gauge galvanized steel and shall include rectangular duct mounting collars.

B. A hinged or removable panel shall be provided in the fan cabinet of sufficient size to permit access for service to all of the fan's internal components without dismantling the cabinet.

C. The fan wheel shall be of the galvanized steel, forward curved, centrifugal type. Wheels shall be dynamically and statically balanced.

D. Motors shall be of the heavy duty type with permanently sealed ball bearings. The wheel shaft shall be ground and polished steel mounted in permanently sealed pillow block bearings. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the machined cast iron type, keyed and securely attached to the wheel and motor shafts. The motor pulleys shall be adjustable for final system balancing.

E. All fans shall bear the AMCA Certified Ratings Seal for air performance.

F. Provide each fan with an insulate dousing, disconnect switch and rubber-in-shear hanging support system.

G. All belt driven exhaust fans shall have a NEMA rated adjustable motor base.

H. Fans shall be Model BSQ manufactured by Greenheck Fan Corporation or approved equivalent.

2.2 ROOF EXHAUSTER - CENTRIFUGAL:

A. Fan performance shall be based on tests conducted in accordance with AMCA Standard 210 and fan shall bear the AMCA certified rating seal.

B. Housing shall be corrosion resistant spun aluminum with aluminum curb cap, heavy cast iron frame, with stainless steel lockable hasp for easy access to all fan components. Upblast or downblast type, per schedule.

C. Wheel shall be of all aluminum construction with backwardly inclined blades, non-overloading and statically balanced.

D. Fan motor, drive and ball bearings shall be mounted above the fan wheel in a compartment isolating these components from the air handled by the fan.

E. Fans shall have adjustable sheaves for speed variation.

F. Motor shall be pre-wired to a safety disconnect switch mounted adjacent to motor.

G. Fan shall be provided with a bird guard of fused coated heavy gauge steel.

H. Fan shall be provided with multi-leaf felt edged, spring loaded barometric back draft damper. Damper shall be mounted n curb below fan.

I. Fan shall be provided with an electrical motor and motor control as specified elsewhere.

J. Exhauster shall be as manufactured by Jenn-Air, Greenheck, Loren Cook.

K. Provide pre-fabricated roof curbs compatible with fans. Roof curbs shall be installed under this category.

L. Wheel shall be of all aluminum construction with backwardly inclined blades, non-overloading and statically balanced.

M. Fan motor, drive and ball bearings shall be mounted above the fan wheel in a compartment isolating these components from the air handled by the fan.

N. Fans shall have adjustable sheaves for speed variation.

O. Motor shall be prewired to a safety disconnect switch mounted adjacent to motor.

P. Fan shall be provided with a bird guard of fused coated heavy gauge steel.

Q. Fan shall be provided with UL label.

R. Fan shall be provided with an electrical motor and motor control as specified elsewhere.

S. Provide pre-fabricated roof curbs compatible with fans. Roof curbs shall be installed under this category of work.

T. Provide grease cup and hinged access for all kitchen hood exhaust fans.

PART 3 - EXECUTION:

3.1 IN-LINE CENTRIFUGAL FANS:

A. Vibration isolators shall be provided as specified elsewhere. In cases of fans where more than one speed is specified, isolators shall be selected for the lowest speed. The motor and fan base shall be welded or bolted to form a common base to prevent any movement of the fan and motor.

B. Provide additional adjustable or fixed sheaves at no additional cost, if required for balancing. Submit certified fan performance curves.

3.2 ROOF EXHAUSTER - CENTRIFUGAL:

A. Curbs shall be installed under this category of work.

END OF SECTION 23 34 13

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PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. This work consists of providing all labor, materials, equipment, and services necessary for the installation of terminal units for the heating, cooling, and ventilation systems as indicated on the drawings, required, and as specified.

1.2 SUBMITTALS:

A. Shop drawings shall be submitted on all items in accordance with the provisions of specification Section 23 01 00.

B. Important Electrical Power Requirements for VAV Units:

1. Each unit shall be provided with power disconnect switch complying with National Electrical Code requirements.

2. Units are being power wired under Division 26 Electrical with circuits that include wire size and circuit breakers as indicated on equipment schedule, if so shown on HVAC drawings, or as shown on electrical drawings, if no schedule on HVAC drawings is shown. The power circuits being provided under Division 26 Electrical for these units have been sized in accordance with the available data at the time of the design. Any deviation in unit power wiring requirements from what is being provided under Division 26 Electrical, whether due to change in KW or HP rating of unit by contractor, or unit vendor, or due to unit nameplate wiring requirements, will result in additional wiring system costs.

3. HVAC contractor shall be responsible for all additional wiring system costs, including claims due to construction delays, derived from providing units too large or too small to fit the power wiring system being provided under Division 26 Electrical. The same applies for all additional wiring cost required to satisfy unit nameplate requirements if nameplate requirements are different than what is being provided under Division 26 - Electrical under the construction contract.

4. HVAC contractor shall equally be responsible for providing any additional fuses and fuse housing equipment required by furnished units when nameplates require installation of fuses outside the unit.

PART 2 - PRODUCTS

2.1 VARIABLE AIR VOLUME REHEAT TERMINAL:

A. The variable volume unit shall be throttling type and suitable for low and medium pressure systems as required. The room thermostat shall modulate the control damper in the unit to vary the air flow to satisfy the room's cooling requirement. Total leakage of casing and valve shall not exceed 3% at 3" inlet static pressure. The control unit shall be inlet duct pressure independent and shall be able to deliver desired CFM with inlet pressure variation up to 4 inch W.G. The box shall have differential pressure taps to allow readout of air quantity being delivered.

B. The control unit shall be factory set for minimum and maximum air quantity. Provide external means for limiting maximum and minimum flow for field adjustment. The control

valve shall be normally open. Factory air flow test each unit and set CFM to within 5% of design CFM.

C. Casing:

1. The unit casing shall be constructed of minimum 22 gage hot dipped galvanized steel. The unit shall be factory insulated with 1 inch thick minimum 1-1/2 lb. density thermal and acoustical insulation without any exposed or raw edges. The surface of the insulation shall be treated to prevent erosion and shall conform to UL Test 181. The insulation must be UL approved and shall comply with NBFU and NFPA 90A requirements.

D. Noise:

1. Maximum total static pressure available at the box inlet is as scheduled in the drawing. The total static pressure includes the pressure drop through the duct at the discharge side of the box, flexible connection to the air supply boots or supply diffuser and the supply diffuser and/or supply air boots. Maximum noise level in the room shall be NC 30 with maximum 8db room absorption and minimum 5 ft. acoustically lined duct at the discharge of the control box. Minimum number of control boxes shall not be reduced. The Contractor shall make and coordinate all necessary changes resulting from the use of terminals other than those used for the base design.

E. VAV units shall be manufactured by Trane or Nailor.

PART 3 - EXECUTION

3.1 GENERAL

A. All terminal units shall be installed in strict accordance with the manufacturer's recommendation and as shown on the drawings.

B. Care shall be taken in the storage and erection of these boxes that they are protected from dirt and other construction debris. The protective inlet and discharge covers shall be kept on the units until ductwork is actually connected.

C. Install air control devices in a horizontal position per manufacturer's installation instructions and recommendations.

D. Coordinate connection with the electrical contractor of all electrical wiring and low voltage wiring to air control devices as required.

E. Locate each air control device so that access panels, electric reheat coils and its associated valves and any other moving operator are accessible for removal and/or maintenance. Provide a minimum of 18 inches clearance from the side of the device to the nearest obstruction for this purpose. Units with heating coils requiring 460V/3-phase power require 3-foot clearance.

F. Install units with a minimum of 3 diameters of straight metal duct upstream of the unit connection. Provide a flexible duct connection between the unit duct connection and the branch duct.

G. Install a flexible duct connection at the discharge of FP units.

H. Install FP units suspended from the structure above with threaded rod hangers, rubber grommets, and hanger brackets as detailed on the drawings.

END OF SECTION 23 36 00

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PART 1 - GENERAL

1.1 GENERAL

A. This work consists of furnishing all labor, materials, equipment and services necessary for the installation of air distribution devices for the heating, cooling, and ventilation systems as indicated on the drawings, required, and as specified.

PART 2 - PRODUCTS

2.1 GRILLES AND REGISTERS:

A. Provide where shown on the drawings all metal grilles and registers of the sizes and capacities indicated. Units shall be adaptable for use with walls and ceilings as indicated on the architectural finish schedule.

B. All supply registers on plans shall have front bars parallel to short dimension and rear bars parallel to long dimensions and opposed blade register behind grille. They shall be Nailor, Titus or approved equal.

C. All return and exhaust registers indicated shall have fixed face bars set at 45 degree angle and parallel to long dimension and parallel blade register. They shall be Nailor, Titus or approved equal. This shall be operated from the face of the register with a removable key.

D. All grilles and registers shall be factory coated with baked off-white enamel finish or a color to be selected by Architect. All grilles and registers shall be furnished with 1/4" sponge rubber gasket around the grille frame.

E. In all cases, a schedule of grilles and registers shall be prepared and submitted to the Architect and Engineers for approval of size and design of outlets before they are ordered for installation.

F. All grilles and registers of sizes indicated or required, or equivalent areas as approved, shall be furnished and installed where shown on the drawings, or as required.

G. Note:See Air Distribution schedules on drawings for a complete list of ceiling outlets.

2.2 CEILING DIFFUSERS:

A. Provide where shown on the drawings all metal diffusers of the sizes and capacities indicated. Units shall be acceptable for use with ceilings as indicated on the architectural finish schedule.

B. Ceiling diffusers shall be selected to diffuse the air uniformly throughout the occupied space. The sound power level of air distribution equipment devices shall not exceed NC 30 unless otherwise noted.

C. Equipment manufacturer shall submit engineering data in a manner to facilitate convenient review of the following factors:

1. All grilles and registers located in janitor and toilet rooms and other damp locations shall be constructed entirely of aluminum.
2. All air distribution equipment shall be as manufactured by Nailor or equal by Titus.
3. Where arrow on plans indicate air flow through a partition to a corridor, etc., a grille shall be provided for each face of wall.
4. All ceiling diffusers shall be furnished and installed with an equalizing grid and volume damper as scheduled.
5. Diffusers shall be located to provide a symmetrical pattern with ceiling tile, light fixtures and other ceiling elements. All locations shall be verified by the Architect.
6. All diffusers shall be factory coated with baked enamel finish of color to be selected by Architect.
7. Each air supply outlet shall have the required capacity, and shall be guaranteed to give the required draft with draftless diffusion. Where manufacturer's recommendations require duct sizes differing from those on the drawings, the same shall be provided at no additional cost to the owner.

2.3 SLOT DIFFUSERS:

A. Damper Vanes: Internal, adjustable from face of diffuser without removing or disturbing installation. These variable vanes shall provide 180 degree discharge pattern, left, right or vertical adjustable in each slot. Diffuser: Nailor 5800 or approved equal for all ceiling slot diffusers. Provide end caps and alignment guides.

B. Diffuser Frame: Connected to acoustically lined plan as indicated on detail. Connect plenum to supply duct or supply branch take-off as indicated on drawings with flexible duct.

C. Slot diffusers as indicated on ventilation data sheets indicate only slot diffusers used to supply air.

D. Provide an insulated plenum with an inlet collar for each slot diffuser.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install all equipment and appurtenances in strict accordance with approved shop drawings and manufacturer's recommendations.

B. Install square and perpendicular to the building general construction.

C. All sidewall grilles shall be installed level and plumb. All margins to gypsum board construction shall be caulked before finish painting.

END OF SECTION 23 37 13

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Conditions of the Contract of this Project Manual apply to this Section as though repeated herein.

B. Refer to plans for layout, schedule and special notes.

1.2 SUMMARY

A. Section Includes:

1. Recirculating dust extractor
2. Related accessories
3. Compliances

1.3 SUBMITTALS

A. Product Data: Indicate manufacturer's model number, technical data including description of components, filtration efficiency, performance, noise level, accessories and installation instructions.

B. Closeout Submittals: Operation and Maintenance Manual including spare parts list.

1.4 QUALITY ASSURANCE

A. Engage an experienced installer to perform work of this Section who has completed installations similar in design and extent to that indicated for this Project, and who has a record of successful in-service performance.

B. All components shall be fabricated in strict accord with standards set forth in the current edition of ISO 9001 and ISO 14001.

C. Engage a manufacturer with minimum 10 years proven U.S. experience in manufacturing Filtration Systems similar to that indicated for this Project and with a record of successful in-service performance.

D. Conduct conference at Project site. Review methods and procedures related to the dust collector system installation.

1. Review access requirements for equipment delivery.
2. Review equipment storage and security requirements.
3. Inspect condition of preparatory work performed by other trades.
4. Review structural loading limitations.
5. Review that all components specified in this Section and related components specified in other Sections are accounted for.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading: Store in original protective packaging, covered and in a dry location.

1.6 PROJECT/SITE CONDITIONS

A. Verify dimensions installation areas by field measurements.

1.7 COORDINATION

A. Coordinate layout and installation with other work, including light fixtures, fixed equipment and workstations, HVAC equipment and equipment of movement such as overhead cranes.

B. Coordinate location and requirements of service-utility connections.

PART 2 - PRODUCT

2.1 HOUSING

A. The Recirculating Fume Extractor shall be a high efficiency filtration unit. It shall be bolted galvanized steel construction, clean air chamber 14 gauge thick galvanized steel, dirty air chamber 14 gauge galvanized steel and hopper typically 14 gauge galvanized steel. This construction shall be designed to withstand a maximum –16” w. g. to +6” w.g. working pressure.

B. The unit shall include galvanized steel flanged air exhaust inlets. They shall be located in the center two modules to provide maximum airflow distribution and internal minimal airflow restrictions.

C. The unit shall have hinged and locking filter access doors, each accessing 8 filter cartridges. Doors shall be galvanized steel construction, bolt-on construction to provide an airtight seal upon closure.

2.2 HOPPER(S)

A. The Filtration Unit shall have a minimum of 2 hoppers. Each shall be 14 gauge, bolted, galvanized steel construction with each including a 55 gallon drum cover, hose, clamps, and 55 gallon drums.

1. Additional equipment with 55 GAL DRUM

B. A manual slide gate will be included on the bottom of each hopper with a 55 gallon drum cover transition mounted on the bottom of each manual slide gate.

2.3 CONTROL BOX

A. The unit dedicated control box shall meet the following:
1. UNIT SHALL BE UL LISTED FOR INSTALLED UNIT AS A WHOLE.

2. 0-20 inch H2O pressure range
3. Temperature rating of -4 to 140°F
4. Maximum Installed Altitude of 10,000-feet ASL

2.4 FILTERS

A. The Filtration Unit shall contain 32, CA178 80/20 cellulose, or similar - synthetic flame retardant media. The filters shall be vertical round filters, 156 sq ft per cartridge.
1. Material: 80/20 Cellulose & Synthetic blended paper w/nano-fiber
2. Maximum Operating Temperature: 200 °F
3. Material Basis Weight 152 grams per square meter.
4. Permeability: 20
5. Dry Mullen Burst Pressure: 50 psi
6. MERV: 15 minimum

B. The maximum standard static pressure drop across the unit shall be 5” w. g. Filter exchange shall be performed on the dirty side of the filters through side access doors.

C. The filter cartridges shall be cartridge type designed to provide a balanced dust loading across the cartridge filter and provide a stronger pulse energy across the filter cartridge media.

2.5 FAN

A. The fan(s) shall be two, utility set type, 5 HP fans, rated 4,000 CFM each. Straight blade, backward inclined, high efficiency type fan wheel. Steel housing and steel fan wheel construction, powder painted, direct drive mounting. Maximum operating air temperature of 167°F and maximum ambient condition of 122°F. Fan wheel shall be balanced per Q6,3 ISO 1940/1. Motor shall be TEFC, 1800 RPM nominal, and 30 HP output rated. The utility fan shall be ground mounted with Quick-Fit ducting to connect filtration unit.

2.6 CLEANING SYSTEM

A. The filter cartridge shall be cleaned by an automatic reverse pulse compressed air cleaning system. The integrated main control box shall have settings for online or offline cleaning, along with a full range of pause time between cleanings during online cleaning and a set number a pulse cleaning cycles after the filtering system has been switched offline. A combined solenoid/diaphragm valve, located on a compressed air tank, is wired to the control box for control of valve on/off time, and time between pulse cycles. Each diaphragm valve is connected to a blowpipe design to clean 4 cartridges at one time and evenly distributes the compressed air pulse across each filter cartridge. The compressed air system shall operate with a supply of oil free and water free compressed air at 90 psi. Compressed air consumption shall be 13 cubic feet per minute maximum while operating in run mode.

2.7 DUCTWORK FOR CARPENTRY EXHAUST

A. Provide spiral or stamped galvanized duct with paint grip finish. Ductshall be snaplock type, rated for -6-inch w.c. in all sizes, per SMACNA. NO INTERIOR SCREWS OR INTERRUPTION IN AIRFLOW.

2.8 ACCEPTABLE MANUFACTURERS

A. Products, which comply with this specification as judged by the Architect/Engineer may be provided by the following manufacturers. All products specified in this section shall be provided by a single manufacturer.

1. Nederman, Dayton or Donaldson

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, service-utility connections, and other conditions affecting installation and performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide surface/substrate preparation as required by the manufacturer's printed installation instructions. Do not proceed with installation until site is in proper condition to receive the Dust Collector.

3.3 INSTALLATION

A. Install equipment in accord with manufacturer’s written instructions, original design and referenced standards.

B. Installation, testing and startup by mechanical contractor.

3.4 ADJUSTING

A. Adjust the Dust Collector if needed, for proper operation. Replace any parts that prevent the system from operating properly.

3.5 CLEANING

A. Remove all debris caused by installation. Clean all exposed surfaces to as fabricated condition and appearance.

3.6 PROTECTION

A. Provide protection of the completed installation until completion of the project. Repair any damage at no additional cost to Owner.

3.7 DEMONSTRATION / TRAINING

A. Provide the end user a minimum of one hour of hands-on demonstration and operation of the Dust Collector and related equipment.

3.8 WARRANTY

A. Provide a written warrantee for a period of one year from date of substantial completion for all components.

END OF SECTION 23 38 55

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Instructions to Bidders, General and Supplementary Conditions, shall govern the work under this Division or Section the same as if incorporated herein. The attention of the Subcontractor of this Divisions or Section is directed to the Instructions to Bidders concerning substitution of materials and equipment.

B. Division 26 documents shall apply with regard to the installation and termination of power wiring.

1.2 DESCRIPTION OF WORK

A. Furnish and install split system air conditioners complete with all accessories as described in these specifications and on the project drawings.

B. Split system air conditioners shall be complete systems with indoor air handling unit, outdoor unit, and controls. Air handling unit and outdoor unit shall be by the same manufacturer.

C. Contractor shall furnish and install the equipment described below as specified, unless his product cannot meet a stated requirement. In that case only, the submittals shall list specifically any and all exceptions to this specification, with explanation, proposed alternative, and effect on pricing and/or performance, if applicable.

1.3 QUALITY ASSURANCE

A. Equipment shall be certified as being in compliance with American Refrigeration Institute (ARI) standard(s) for that type of equipment.

B. Conform to NFPA 90A for the installation air conditioning unit and references.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.4 WARRANTY

A. Warranty: The indoor and outdoor units shall be furnished with full coverage warranty against defects in materials and workmanship for any and all failures except failure due to misuse or external damages. Warranty on the complete unit shall be for one year from date of acceptance by the owner (date of start-up with acceptable operation). On the compressors, the warranty shall be extended for four years, for a total of five years from date of acceptance by owner.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Split system air conditioners shall be packaged system complete with indoor air handler equipped with supply air fan(s), cooling coil, and outdoor unit equipped with condensing coil, outdoor fan, and compressor.

B. The indoor and outdoor units shall be of the same manufacturer with certified performance from the manufacturer.

C. The matched system shall be certified by the manufactured to be in compliance with the requirements of International Energy Code.

D. All system components shall be UL listed.

E. Demonstrate the operation (and monitoring points on the BAS if Alternate No.1 is accepted). Provide written instructions; include set point changing, in an operator's manual.

2.2 INDOOR UNIT

A. Product Description: Ductless type evaporator for high wall / mounting shall be provided with remote wall mounted infrared compatible controls.

B. Controls/Components:

1. Controls and components include:

    a. Relays and connections for condensing unit.

2. Unit mounted Digital Controls:

    a. Thermostat-post purge fan control
    b. Fan speed control with auto ramping
    c. Straight Cool compatible (dipswitch setting)
    d. Digital Set Point and room temperature display
    e. Cycling or constant fan modes
    f. Hanger mounting kit

3. Installer Supplied Items:

    a. Power wiring
    b. Low voltage wiring
    c. Mounting screws, fasteners
    d. Refrigerant piping (if not supplied)
    e. Condensate piping

2.3 OUTDOOR UNIT

A. Condensing units shall be air-cooled, high efficiency units.

B. The SCC/SHC condensing units shall provide cooling and heating for a single evaporator.

C. Provide 24V control interconnection to the evaporator. All valves shall be internal to reduce tampering. All units shall be equipped with a large capacity suction accumulator with surge baffles and enhanced oil management, a factory installed, solid core filter drier, and loss of refrigerant charge protection. Crankcase heater shall be installed as a part of the low ambient control.

D. A 0°F compressor cut-out is fitted for maximum system reliability.

E. Capacities/Efficiency: Unit shall produce system SEER's exceeding 10.0.

F. Cabinet Construction:

1. Fabricated of G60 galvannealed steel.
2. Finished in off white with corrosion inhibiting, polyester, powder-coated paint (2000 hour salt spray-tested)

G. Fan Guard: Integral to Cabinet.

H. Compressor: Hermetically sealed, high efficiency rotary or reciprocating type, depending on unit capacity. Motor is PSC type with internal overload protection. Compressor is installed on resilient mountings.

I. Refrigeration Circuit: Provide a pre-charged refrigerant for the condenser coil and evaporator. Charging of the field installed piping is required. Unit refrigeration valves shall be solid brass, for sweat connection.

J. Condenser Coil: Condenser coil is seamless, copper tubing, arranged in staggered configuration, with enhanced aluminum fins. The tubes are mechanically expanded for secure bonding to fin shoulder.

K. Condenser Fan/Motor: The condenser fan is a large diameter, high efficiency, three blade propeller type, directly connected to the totally enclosed 8 pole, PSC motor. The motor is fitted with internal thermal protection. Units shall be draw-through air flow design.

L. Controls/Components: Compressor and Fan Motor Contactor

a. Capacitor
b. Loss of charge switch (9-15 only)
c. Low voltage transformer
d. Low voltage interconnect
e. Large capacity suction accumulator
f. Defrost control board and termination switch
g. Factory installed solid core filter drier
h. Low ambient option shall be provided to operate in cooling mode at outside temperatures below 60°F).

2.4 SHORT-CIRCUIT CURRENT RATING:

A. The unit short-circuit current rating shall meet or exceed the short circuit interrupting rate of the circuit breaker ahead of the branch circuit feeding the unit.

PART 3 - EXECUTION

3.1 OUTDOOR UNIT INSTALLATION

A. Split system outdoor units shall be installed according to manufacturer's recommendations regarding refrigerant line sizes, routing, drip legs, double risers, traps, etc.

B. The outdoor unit shall be installed on a concrete pad and located such that the manufacturer's recommended clearances for service and proper air flow are met.

C. Coordinate with the requirements listed under Division 26 for the installation of unit disconnect. Provide supervision and coordination to assist in the termination of power wiring specified under Division 26.

3.2 INDOOR UNIT INSTALLATION

A. Install the indoor unit level with clearance for service in accordance with the manufacturer's recommendations.

B. Coordinate with the requirements listed under Division 26 for the installation of unit disconnect. Provide supervisions and coordination to assist in the termination of power wiring specified under Division 26.

3.3 START-UP

A. Operate the air handler and outdoor unit and check the operation of all controls.

B. The unit shall be fully inspected and cycled through all operating modes by the start-up technician. Upon request a start-up report shall be provided to the architect/owner/engineer. As a minimum, the start-up report shall include operating charge, amperage, and voltage.

END OF SECTION 23 68 50

SECTION 23 70 70 – PACKAGED ROOFTOP HEATING & COOLING UNITS

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Provide rooftop units and all necessary services, accessories, etc. as shown on the Drawings, as scheduled and as specified below.

1.2 SHOP DRAWINGS:

A. Shop drawings shall conform to Section 23 01 00 as well as the following.

1. Rooftop unit manufacturer shall submit and be responsible for all components, all wiring and controls of rooftop units.
2. Drawings shall include overall dimensions, clearances and service requirements.
3. Structural steel drawings with coordinated framing plan shall be submitted with rooftop unit shop drawing and shall have “approved” stamps from both the mechanical subcontractor and the general contractor.
4. Rooftop manufacturer shall coordinate all control points with BAS sub-contractor prior to bidding and again prior to submittal for a fully coordinated set of documents.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Units shall be specifically designed for outdoor rooftop installation on a roof curb and be completely factory assembled and tested, piped, internally wired, fully charged with R-410A, compressor oil and shipped in one piece. Units shall be available for direct expansion cooling, filters, 100% outside air system, 100% exhaust air system, non-fused disconnect switches and all operating and safety controls shall be furnished factory-installed. All units shall be UL approved and factory run tested. Cooling capacity shall be rated in accordance with ARI Standard 360. All units shall have decals and tags to aid in service and indicate caution areas. Electrical diagrams shall be printed on long life water resistant material and shall ship attached to control panel doors.

B. Units shall be Trane Voyager and Horizon or similar by JCI or Carrier.

2.2 CASING:

A. Exterior panel shall have a minimum of 1.25 ounce zinc coating per square foot of steel, phosphatized and painted with a slate grey finish which meets a 672 hour salt spray test based on the ASTM B117 standard for all salt spray resistance. Screws shall be coated with zinc-plus-zinc chromate. Eighteen gauge steel hinged access panels with tiebacks to secure door in open position shall provide access to filters and heating sections. Refrigeration components, supply air fan and compressor shall be accessible through removable panels as standard. Unit control panel shall be accessible through hinged access panel with quick release latches. Double wall construction hinged access doors shall provide access to filters, return/exhaust air, heating and supply fan section. All access doors and panels shall have neoprene gaskets. Interior surfaces or exterior casing members shall have 1/2" Tuf-Skin fiberglass insulation. Unit base shall be watertight with 14 gauge formed load bearing members, formed recess and curb overhang. Unit lifting lugs shall accept chains or cables for rigging. Lifting lugs shall also serve as unit tiedown points.

2.3 GAS HEATING: (Modulating burner – Not Staged)

A. The heating section shall have a drum and tube heat exchanger design using corrosion resistant steel components. A forced combustion blower shall supply premixed fuel to a single burner ignited by a pilotless hot surface ignition system. In order to provide reliable operation, a negative pressure gas valve shall be used that requires blower operation to initiate gas flow. On an initial call for heat, the combustion blower shall purge the heat exchanger 45 seconds before ignition. After three unsuccessful ignition attempts, the entire heating system shall be locked out until manually reset at the thermostat. Units shall be suitable for use with natural gas or propane (field installed kit) and also comply with California requirements for low NOx emissions.

2.4 REFRIGERATION SYSTEM:

A. Compressors:

1. 3-D Scroll compressors with only three major moving parts with scroll type compression with low vibration. A 3-D compliance provides a completely enclosed compression chamber for increased efficiency. Exhaustive testing on the 3D Scroll, including start up with the shell full of liquid, has proven that slugging does not fail involutes. Direct-drive 3600 rpm, suction gas-cooled hermetic motor. Scroll compressor complete with centrifugal oil pump, oil level sightglass and oil charging valve.

2. Control of compressor shall allow lead/lag of multiple compressors/circuits for even run time to increase life of compressors.

B. Evaporator Coil:

1. Internally enhanced seamless copper tubing of ½" O.D. shall be mechanically bonded to heavy-duty aluminum fins of configured design. Minimum row depth shall be (4) rows.
2. All coils shall be equipped with thermal expansion valves and factory pressure and leak tested at 300 psi.

C. Condenser Coil:

1. Configured aluminum fin or configured copper fin secondary surface shall be mechanically bonded to primary surface of 3/8" O.D. seamless copper tubing. Subcooling circuit shall be provided as standard. All coils shall be factory tested at 450 psig air pressure and vacuum dehydrated.
2. All vertically mounted coils shall be provided with inlet hail screen guards and external coating for harsh environment.

D. Condenser Fans and Motors:

1. All condenser fans shall be vertical discharge, direct drive fans, statically balanced, with steel blades and zinc plated steel hubs. Condenser fan motors shall be three-phase motors with permanently lubricated ball bearings, built-in current and thermal overload protection and weather tight slingers over the motor bearings. Motors shall be premium efficiency per EneryStar/EPA spec.

2.5 AIR HANDLING SYSTEM:

A. Supply Fan:

1. All supply fans shall have two double inlet, forward-curved fans mounted on a common shaft with fixed sheave drive and shall be dynamically balanced and tested in factory. Supply fan shall be test run in unit as part of unit test and unit shall reach rated rpm before the fan shaft passes through first critical speed. Fan shaft shall be mounted on two grease lubricated ball bearings designed for 200,000 hours average life. Extended grease lines shall allow greasing of bearings from unit filter section. Fan motor and fan assembly shall be mounted on common base to allow consistent belt tension with no relative motion between fan and motor shafts. Entire assembly shall be completely isolated from unit and fan board by 2" deflection spring isolation on motor. All supply fan motors meet the latest U.S. Energy Policy Act premium efficiency and provided with shaft grounding rings.

B. Controls:

1. Unit shall be complete factory wired with necessary control and contactor pressure lugs or terminal block for power wiring. Units shall provide an internal location for a non-fused disconnect with external handle for safety. Unit mounted microprocessor controls shall provide anti-short cycle timing for all compressors. A variable frequency drive assembly shall be provided to vary the fan speed to meet the load conditions.

C. Unit Controller:

1. DDC microprocessor controls shall be provided to control all unit functions. The control system shall be suitable to control VAV applications. The controls shall be factory installed and mounted in the main control panel. All factory installed controls shall be fully commissioned (run tested) at the factory. The unit shall have a Human Interface Panel with a 16 key keypad, a 2 line X 40 character clear English display as standard to provide the operator with full adjustment and display of control data functions. The unit controls shall be used as a standalone controller, or as part of building management system involving multiple units. Unit shall have a LON interface with Building BAS.

2. The unit shall be equipped with a complete microprocessor control system. This system shall consist of temperature and pressure (thermistor and transducer) sensors, printed circuit boards (modules), and a unit mounted Human Interface Panel. Modules (boards) shall be individually replaceable for ease of service. All microprocessors, boards and sensors shall be factory mounted, wired and tested.

3. The microprocessor boards shall be standalone DDC controls not dependent on communications with an on-site PC and Building Management Network. The microprocessors shall be equipped with on-board diagnostics, indicating that all hardware, software and interconnecting wiring are in proper operating condition.

4. The modules (boards) shall be protected to prevent RFI and voltage transients from affecting the board's circuits. All field wiring shall be terminated at separate, clearly marked terminal strip. Direct field wiring to the I/O boards is not acceptable.

5. The microprocessor's memory shall be non-volatile EEPROM type requiring no

battery or capacitive backup, while maintaining all data.

6. The Human Interface Panel's keypad display character format shall be 40 characters x 2 lines. The character font shall be 5 x 7 dot matrix plus cursor. The display shall be Supertwist Liquid Crystal Display (LCD) with blue characters on a gray/green background which provides high visibility and ease of interface. The display format shall be in clear English. Two or three digit coded displays are not acceptable.

7. The keypad shall be equipped with 16 individual touch-sensitive membrane key switches. The switches shall be divided into four separate sections and be password protection from change from unauthorized personnel. The six main menus shall be STATUS, SETPOINTS, DIAGNOSTICS, SETUP, CONFIGURATION, and SERVICE MODE.

8. Short Circuit Current Rating: The unit short-circuit current rating shall meet or exceed the short circuit interrupting rate of the circuit breaker ahead of the branch circuit feeding the unit.

2.6 FILTERS:

A. Filters shall mount integral within unit and be accessible by hinged access panels.

B. Provide a high static pressure filter sensor and alarm.

2.7 HIGH EFFICIENCY PANEL FILTERS:

A. Shall be 2" high efficiency MERV 13 media filters accordance with the most recent version of ASHRAE 52.

2.8 EXHAUST AIR:

A. Modulating 100% Exhaust Fan with building pressure Control:

B. Two, double-inlet, forward-curved fans shall be mounted on a common shaft with a fixed sheave drive. All fans shall be dynamically balanced and tested in factory before being installed in unit. Exhaust fan shall be test run as part of unit final run test. Unit shall reach rated rpm before fan shaft passes through first critical speed. Fan shaft shall be mounted on two grease lubricated 10/200,000 ball bearings average life. Extended grease lines shall be provided to allow greasing of bearings from the unit filter section. Fan motor and assembly shall be mounted on common base to allow consistent belt tension with no relative motion between fan and motor shafts. Entire assembly shall be completely isolated from unit and fan board by spring isolation on motor. The 100% modulating exhaust discharge VFD shall be modulated in response to building pressure. A differential pressure control system, control system shall then modulate the VFD to control the building pressure to within the adjustable, specified dead band that shall be adjustable at the Human Interface Panel. All exhaust fan motors meet the most recent version of the U.S. Energy Policy Act.

2.9 OUTSIDE AIR:

A. 0-100% Modulating Economizer:

Operated through the primary temperature controls to automatically utilize OA for "free" cooling. Automatically modulated return and outside air dampers shall maintain proper temperature in the conditioned space. Economizer shall be equipped with an automatic

lockout when the outdoor enthalpy temperature is too high for proper cooling. Minimum position control shall be standard and adjustable at the Human Interface Panel or with a remote potentiometer or through the building management system. A spring return motor shall ensure closure of OA dampers during unit shut-down or power interruption.

B. Mechanical cooling shall be available to aid the economizer mode at any ambient. Ultra low leak economizer dampers shall be standard with a leakage rate of 1.0% of nominal airflow (400 CFM/ton) at 1" w.g. static pressure.

C. Provide a factory mounted airflow measurement station (AMS) on each unit outside air intake through flow measuring dampers or standalone station made for outdoor installation. The AMS shall measure 5 FPM to maximum airflow.

2.10 ROOF MOUNTING CURB:

A. Refer to drawings.

2.11 ELECTRONIC ZONE SENSORS:

A. See Temperature Controls.

2.12 SYSTEM CONTROL:

A. Exhaust Return Fan Variable Frequency Drives without bypass. Provided with all the necessary controls to control/maintain building space pressure through a VAV rooftop unit. The variable frequency drive (VFD) modulates the speed of the exhaust fan motor in response to building pressure. A differential pressure control system uses a differential pressure transducer to compare indoor building pressure to atmospheric pressure. The VFD received a 0-10 vdc signal from the unit microprocessor based upon the space static pressure and causes the drive to accelerate or decelerate as required to maintain the space pressure within the deadband.

B. VAV Supply Air Temperature Control with Variable Frequency Drives without Bypass - Provided with all necessary controls to operate a VAV rooftop unit from the discharge air temperature, including discharge air microprocessor controller and discharge air sensor. The microprocessor controller coordinates the economizer control and the stages of cooling with discharge air temperature reset capabilities. Includes factory installed and tested variable frequency drives (VFD) to provide supply fan motor speed modulation. VFD received 0-10 vdc from the unit microprocessor based upon supply static pressure and causes the drive to accelerate or decelerate as required to maintain the supply static pressure set point.

2.13 AMBIENT CONTROL:

A. Controls shall be provided to allowance unit refrigeration system operation down to 50 deg F ambient outdoor air temperature.

2.14 AGENCY APPROVAL:

A. Rooftops must be provided with UL approval.

2.15 MISCELLANEOUS OPTIONS:

A. Non-fused Disconnect Switch with External Handle - External handle enables the operator to disconnect unit power with the control box door closed for safety.

B. Hot Gas Bypass - Valves, piping and controls are all included to allow operation at low airflow, avoiding coil frosting and damage to compressor.

C. High Duct Temperature Thermostats - Two manual reset thermostats, one located in the discharge section of the unit set at 240 F and the other in the return section set at 135F. The rooftop will shut down if the thermostats are tripped.

D. Building Automation System - BACNET Interface.

E. High Efficiency Motors - Supply and exhaust fans are provided with high efficiency motors.

F. Extended Grease Lines - Lines allow greasing of supply and exhaust fan bearings through the filter access door.

G. Access Doors - Hinged access doors provide easy access to supply fan, filters, exhaust fan and the heating section. These access doors feature double wall construction with dual density insulation sandwiched between 18 gauge and 20 gauge galvanized steel panels for strength and durability.

H. GFI Convenience Outlet (Factory Powered) - A 15V, 115V Ground Fault Interrupter convenience outlet shall be factory installed. It shall be wired and powered from a factory mounted transformer. Unit mounted non-fused disconnect with external handle shall be furnished with factory powered outlet.

I. Two Inch Spring Isolators - Supply and exhaust fan assemblies are isolated with two-inch nominal deflection steel spring isolators.

J. VFD Line Reactors - Provide on all units with VFD.

K. Stainless steel drain pan.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Rooftop units shall be installed in accordance with the shop drawings and the manufacturer's recommendations. The roof curbs shall be continuously supported by shims tack-welded in place to make the curb top flat, square and level.

END OF SECTION 23 70 70

PART 1 - GENERAL:

1.1 SCOPE OF WORK

A. Provide unit heaters where indicated on the drawings

PART 2 - PRODUCTS

2.1 PROPELLER UNIT HEATERS:

A. Unit heaters shall be quiet in operation and shall be suitable for hot water.

B. Fans shall be direct driven, aluminum blades and shall be factory balanced. Provide wire fan guard.

C. Coils shall be copper tube mechanically bonded to aluminum fins and shall be tested at 300 PSI.

D. Motor shall be totally enclosed, permanent split capacitor type with built-in overload protection, and shall be designed for use with unit heater application.

E. Unit shall be enclosed on four sides with a heavy gauge steel casing. Provide adjustable four way louvers on discharge side.

F. Provide remote mounted tamperproof thermostat installed by HVAC Contractor.

G. Manufacturer shall be:

1. Trane
2. Markel
3. Chromolox
4. Electromode

H. All units shall be wired in accordance with National Electric Code and Underwriter's Laboratories, Inc. listed. Junction box for motor cord shall be provided.

I. Motor starters shall isolate units from electric power source for maintenance. Thermal overload device shall protect motor. Overload mechanism shall be reset by moving toggle switch to "off" and then "on" position.

J. Unit control access panel shall be lockable by means of an Allen wrench.

K. Control shall be a wall mounted thermostat.

PART 3 - EXECUTION

3.1 UNIT HEATERS:

A. Install unit heaters as indicated, and in accordance with manufacturer's installation instructions.

B. Uncrate units and inspect for damage. Verify that nameplate data corresponds with unit

designation.

C. Hang units from building substrate, not from piping. Mount as high as possible to maintain greatest headroom possible unless otherwise indicated.

D. Support units with rod-type hangers anchored to building structure. Use steel spring hangers.

E. Install piping as indicated.

F. Protect units with protective covers during balance of construction.

END OF SECTION 23 82 38

PART 1 - GENERAL:

1.1 SCOPE:

A. This work consists of providing all labor, materials, equipment, and services necessary for the proper installation of electric heating units for the heating system as indicated on the construction documents.

B. The electric heating units shall be U.L. approved.

C. Equipment and components principally relevant to this section include:

1. Electric Heaters

PART 2 - PRODUCTS:

2.1 ELECTRIC HEATERS:

A. Electric heaters shall consist of galvanized steel casing with architectural grille, fan and motor, and electric coil. Heating element shall consist of metal sheath finned type electric coil with built-in overload protection. Coil shall be complete with magnetic contactor for each circuit. Fan and motor shall be directly connected with continuous fan duty sleeve bearing motor and broad blade aluminum propeller fan. Unit capacity shall be as scheduled on the drawings. Unit heater shall bear the UL label and shall be wired in strict accordance with the NEC.

B. Unit shall be manufactured by:

1. Markel
2. Trane
3. Electromode
4. or approved equal.

C. Accessories shall include transformer, remote thermostat, circuit breaker, line power disconnect complying with National Electrical Code, and wall sleeve (where scheduled).

PART 3 - EXECUTION:

3.1 GENERAL:

A. Install heater per manufacturer's specifications. Coordinate installation with electrical contractor.

END OF SECTION 23 82 40

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PART 1 - GENERAL

1.1 RECORD DRAWINGS:

A. The HVAC contractor shall keep a record copy of the bid set and fabrication drawings at the job site and shall accurately maintain a record with dimensions and elevations of all changes to the contract drawings as the job progresses. At the completion of the job, the HVAC contractor shall submit updated CADD produced mechanical drawings with discs to the Engineer.

B. Show all valve and equipment numbers.

C. Provide complete equipment and piping schematics showing all devices and all thermometers and gauges.

D. Revise all equipment schedules to show actual equipment furnished.

1.2 DEMONSTRATION OF COMPLETE MECHANICAL SYSTEMS:

A. After installation has been completed, equipment has been tested, systems placed in permanent operation, and all adjustments made, a competent start-up technician shall be provided for a period of seven working days. This technician shall operate the system during this time, and during this time shall instruct the Owner's designated representatives in the operation and maintenance of the equipment. The start-up technician shall be at the site continuously during working hours during the instructional period. Systems to be operated include, but are not necessarily limited to:

1.3 COMMISSIONING OF HVAC SYSTEMS:

A. The systems will be commissioned in accordance with ASHRAE Guideline. It shall be the responsibility of this contractor to prepare, conduct, supervise, and implement this effort to the satisfaction of the engineer. As part of this phase of work and included in this contract shall be all non-destructive testing and adjustments requested by the engineer.

1.4 OPERATING AND MAINTENANCE MANUALS:

A. The form in which the operating maintenance manual is to be presented shall be subject to approval by the Architect. Six copies of the manual shall be provided.

B. The following items, together with any other necessary and pertinent data, shall be included in the manual. This list is not necessarily complete and is only to be used as a guide.

1. Suggested settings of all control and switches for normal operation with description of control and its location.

2. A check list for periodic maintenance of all equipment, with maintenance and cleaning instructions.

3. As built wiring, interlock, and control diagrams for the equipment, with color coding shown on wiring and interlock diagrams.

4. Parts list for all replaceable service parts, and indicate where they may be purchased.

5. Manufacturer's cuts and rating tables for all equipment, including copies of all shop drawings.

6. Oiling, lubricating, and greasing data, showing how to lubricate, frequency, and which lubricants to use.

7. Complete electrical load data from operation tests.

8. Test data on all equipment.

9. Belt sizes, types, and lengths.

10. Serial numbers of all principal pieces of equipment.

11. Valve tag schedule (framed).

12. Manufacturers', suppliers, and subcontractors' names, addresses, and telephone numbers.

13. The first page shall identify project and give name, address and phone number of Architect, Engineer, Mechanical and Electrical sub-contractors and any service companies involved and give name and night phone of each party responsible for service.

14. Copies of the valve tag schedule and wiring diagrams shall be framed under glass and posted in the Equipment Room.

1.5 LABELS, IDENTIFICATION AND TAGS:

A. All control components for equipment shall be identified using 3/4" high permanent engraved bakelite nameplates - white letter-black background, with minimum 1/4" high letters. Nameplates shall be permanently attached to device or to wall or mounting panel above device.

B. All equipment including but not limited to compressors, pumps, equipment cabinets shall be identified with yellow 1 inch high letters. Permanent engraved bakelite nameplates - yellow letters - gray background with minimum 1/4 inch high letters. Permanently attach nameplate to equipment.

C. Tag all valves with 1 inch diameter stamped brass tags numbered in sequence. Tags shall also be identified as to the type of piping. Secure with brass chain.

1.6 VALVE TAG SCHEDULE:

A. Copies of the valve tag schedule and wiring diagrams shall be framed under glass and posted in the equipment room.

1.7 SPARE FILTERS:

A. In addition to the set installed immediately prior to occupancy, minimum of three additional complete sets shall be turned over to Owner's representative.

1.8 WARRANTIES:

A. Deliver to Owner all warranties, guarantees, etc. and obtain written receipts.

1.9 PUNCH LIST:

A. During construction period the Engineer will issue punch lists. These items shall be completed before Engineer will approve next application for payment. Final punch list work shall be completed before acceptance.

1.10 FINAL INSPECTION AND ACCEPTANCE:

A. The architect or his authorized representative will entertain the request for final inspection and acceptance only after the following items are done.

B. Submit a list of uncompleted items, if any, and advise when the items will be done.

C. Complete all items on Architect's or Engineer's prefinal punch list.

D. Final inspection and tests of the completed construction shall be performed in the presence of the Architect or his representative and shall be at such times as are convenient to the Architect. Final tests shall show conclusively that all equipment performs its intended and specified function and that all work complies with the provisions of these specifications. All material, equipment, and instruments required for the tests shall be furnished by this HVAC contractor at his own expense.

1.11 FINAL CLEAN UP:

A. During construction this HVAC contractor shall keep the site clear of debris and upon completion of construction he shall clean up the premises and to remove all evidence of his work.

B. The HVAC contractor shall resolve all questionable items to be corrected prior to an inspection by the Engineer. If items have not been corrected completely, and additional site visits are required for the Engineer to check for compliance, the HVAC contractor will be billed by the Owner at $125.00 per hour plus travel expenses for Engineer's services.

1.12 GUARANTEE:

A. The guarantee shall be as stated in the General Conditions, and the General Provisions of this section.

END OF SECTION 23 90 00

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PART 1 - GENERAL:

1.1 DESCRIPTION OF WORK:

A. The work covered by Division 26 of these specifications consists of furnishing all labor, equipment, supplies, and materials, and performing all operations, including trenching, backfilling, cutting, channeling, chasing and patching necessary for the installation of complete wiring systems in accordance with the contract documents.

B. In addition, the soil boring information included in the specifications or in the drawings is for information to all contractors.

C. The Contract Drawings indicate the extent and general arrangement of the electrical work. The drawings and specifications shall be considered supplementary, one to the other, so that materials and workmanship indicated, called for or implied by the one and not by the other shall be supplied and installed as though specifically called for by both. All labor and material required to perform all work in conjunction therewith whether or not indicated or specified shall be furnished and installed as part of this work.

D. The bidding requirements, general conditions of the contract, forms, and Division 01 - General Requirements are part of Division 26 - Electrical.

E. The electrical subcontractor may also be referred to in this specification as electrical contractor. The electrical contractor may also be referred to in this specification as "this contractor", "contractor" Contractor, or "Division 26 contractor".

F. See section 26 01 11 for Electrical Outline of Work.

1.2 DRAWINGS AND SPECIFICATIONS:

A. It is understood that while drawings shall be followed as closely as circumstances will permit, the Contractor is held responsible for the installation of the system according to the true intent and meaning of the drawings. Anything not entirely clear in the Contract Documents will be fully explained if application is made to the Architect/Engineer in accordance with the General Conditions and Supplements thereto. However, should conditions arise where, in the judgment of the Contractor, certain changes will be advisable, the Contractor shall communicate with the Architect/Engineer and secure his review of these changes before proceeding with the work, provided they are of a major nature.

B. The drawings are diagrammatic and are not intended to show each and every conductor, fitting, device, conduit, or a complete detail of all the work to be performed, but are for the purpose of

illustrating the type system and special conditions necessary for the experienced electrician to take off his material and lay out his work. The Contractor shall be responsible for making such measurements as may be necessary at the Project and adapting his work to the project conditions.

C. Drawings shall not be scaled. Refer to architectural and structural drawings for building construction and dimensions and to room finish schedule or architectural drawings for material, finish and construction method of walls, floor and ceiling in order to insure proper rough-in and installation of work.

1.3 APPLICABLE SPECIFICATIONS AND STANDARDS:

A. The Contractor shall be familiar with the following specifications and standards, as applicable to the materials and methods specified and shall perform all work in accordance with the specifications and standards, and of the issue year that is required by the Authority Having Jurisdiction for work in this project. If the Contractor encounters situations where the Contract Documents contradict the specifications and standards, the Contractor shall bring it to the attention of the Architect/Engineer.

1. AEIC - American Association of Edison Illuminating Companies
2. ANSI - American National Standards Institute
3. ASHRAE/IES - Standard 90.1 - 2013
4. ASTM - American Society for Testing and Materials
5. ETL - Electric Testing Laboratories
6. IBC - International Building Code with North Carolina adopted Amendments
7. ICEA - Insulated Cable Engineers Association
8. IEEE - Institute of Electrical and Electronic Engineers
9. IESNA – Illuminating Engineering Society of North America
10. NEC – National Electrical Code (NFPA 70) - 2020
11. NEMA - National Electrical Manufacturers Association
12. NESC - National Electrical Safety Code
13. UL - Underwriters' Laboratories Inc.
14. OSHA - Occupational Safety and Health Standards
15. Green Globes
16. NC State Construction Office

B. All referenced manufacturer's requirements and specifications and nationally recognized and accepted standards and specifications shall be the latest edition unless specified otherwise and shall be used as they are applicable for products and craftsmanship incorporated in the Contract Drawings. The references to these standards and specifications do not imply acceptance of any and allproducts described in the standards and specifications.

1.4 APPLICABLE REGULATIONS:

A. The installation shall comply with the applicable rules of the 2014 National Electrical code and rules and regulations of the IBC 2012 and ASHRAE 90.1-2007. In no case shall the materials and workmanship fail to meet the minimum requirements of the National Electrical Code.

B. The requirements of the Power Company governing services for transformer concrete pads, switch concrete pads, grounding, primary cable conduits, conduit concrete encasement, communications and metering shall be part of Division 26 – Electrical work. Contractor is responsible for obtaining building permit.

C. An electrical inspection certificate shall be issued by the inspection authority having jurisdiction before work is to be approved for final payment.

1.5 SUBMITTALS:

A. All submittals shall be reviewed, corrected as necessary prior to submitting to Architect/Engineer and stamped "Approved" by the contractor.

B. Materials List:

1. As soon as practicable and within 7 days after the date of award of contract and notice to begin work, and before commencement of installation of any materials or equipment, submit six copies of a complete schedule of the materials and equipment proposed for installation and of names of specialty subcontractors for approval by the Architect/Engineer.
2. The schedule shall, as soon as possible, be supplemented by catalog cuts, diagrams, lighting fixture brochures, shop drawings, field working drawings and such descriptive data as may be required by the Architect/Engineer. In the event any items of materials or equipment contained in the schedule fail to comply with the specification requirements, such items will be rejected.
3. Where shop drawings are called for in other sections of the specifications, the list shall name the manufacturer and item and state "Shop Drawings to Follow."
4. Orders for all approved items shall be placed by the contractor within two weeks after the list is returned to him by the Architect. The Architect/Engineer shall be notified immediately - in writing, of delivery scheduling of the material not ordered for immediate shipment. The first payment estimate will not be approved until the Architect/Engineer is satisfied that all material is ordered and delivery scheduled so that there will be no delay to the job because of getting material. The contractor may be required to remove and replace at his own expense any material installed before approval.

C. Shop Drawings:

1. Shop drawings shall be submitted conforming to the requirements stated in Division 01 - General Requirements and supplementary general conditions for the following items:

    a. Panelboards
    b. Lighting Fixtures
    c. Wiring Devices (receptacles and switches), Coverplates
    d. Dry type transformers
    e. Seismic Attachments
    f. Additional items and systems as specified in technical sections

D. Field Coordination Drawings:

1. Submit field coordination drawings in cooperation with mechanical contractor, as specified in Section 230100. Include, as applicable, lighting fixtures, panelboards,

transformers, cable trays, conduit larger than 1 inch diameter, groups of 5 or more conduits (any size), receptacles and outlets. The drawings shall be produced with a ¼" = 1 ft. scale and shall utilize a separate color for each trade. The field coordination drawings shall include the proposed routing of the outdoor power and telecommunications ductbanks. Although these drawings are not required to be prepared at ¼" = 1 ft. scale.

2. Submit ¼ inch – 1'-0" scaled plans of each electrical equipment room indicating locations of electrical gear, sleeves and conduit penetrations.

E. Factory Record Drawings:

1. Submit three copies of factory final record drawings for panelboards, switchboards, transformers and other specified power gear.

F. Installation Instruction:

1. Submit to the Architect/Engineer manufacturer's installation, operation and maintenance instructions for all electrical protective or operable equipment immediately after the completion of the job. Submit four copies of complete manufacturer's instructions, other than shop drawings, for the following equipment.

   a. Panelboards
   b. Feeder switches
   c. Circuit breakers, including time current for all circuit breakers over 100 amperes.
   d. Dry type transformers
   e. Lighting fixtures

G. Operation and Maintenance Manuals:

1. See General Conditions and Supplements thereto. The contractor shall compile and bind 3 sets of all operation and maintenance manuals, equipment and parts lists, instructions, and descriptive literature furnished by the manufacturers of the furnished equipment to assist in the proper maintenance and operation of equipment. These instructions shall be turned over to the architect with application for final payment, and final payment will not be made until received. Each brochure shall include 1 copy of each of all approved shop drawings, catalog pages, instruction sheets, operating instructions, installation and maintenance instructions, and spare parts bulletins. Refer to Section 269000 for additional requirements.

1.6 EQUIPMENT SIZES:

A. Listing of a manufacturer as a source of acceptable equipment does not relieve the contractor and the manufacturer of this equipment from the requirement of meeting all aspects of the contract documents including that of having to fit the equipment in the space allocated.

1.7 WARRANTY:

A. The electrical contractor shall guarantee by his acceptance of this contract that all work installed will be free from any and all defects in workmanship and/or materials and that all apparatus will develop capacities and characteristics specified.

B. Refer to General Conditions of the Contract and Supplemental to General Conditions for guarantee period.

C. Refer to individual specification sections for special warranty for certain products and systems.

1.8 SITE INSPECTION:

A. Each electrical bidder shall visit the site of the work and familiarize himself with the character and conditions of the job site. The Contractor shall not be excused from doing required work because he did not visit the site.

1.9 RECORD DRAWINGS:

A. The Contractor's competent supervisor shall maintain on the job site one complete set of contract documents of all trades, and shall coordinate with other trades so as to avoid conflicts. The A/E field representative will visit the contractor's office periodically and shall be allowed to inspect the record set of drawings to verify that they are being kept up to date.

B. The Contractor shall provide one set of marked plans to Architect/Engineer for his preparation of record drawings. The marked plans shall indicate all changes and deviations from the original contract documents. Each change shall be marked in a clear, legible manner, keying it to the appropriate change order, clarification note, or field authorization note, as applicable. The use of the field coordination drawings as the record drawings is not acceptable.

1.10 TEMPORARY FACILITIES:

A. Shall be provided as required by the general conditions of the contract.

1.11 CONSTRUCTION UTILITIES:

A. GENERAL REQUIREMENTS OF THE CONTRACT

1. CONCRETE WORK: Concrete work for electrical equipment foundations, curbs, bases, pads, and pedestals shall be provided under Division 26 in conformance with Division 03 - Concrete. Any required concrete tests shall be paid by this contractor.
2. METAL FABRICATIONS: Steel frames, supports and metal assemblies necessary for the installation of electrical systems shall be provided under Division 26 in conformance with Section 05 50 00 - Metal Fabrications.

1.12 PAINTING:

A. All required painting of electrical conduit and items specified under Division 26 - Electrical shall be done under Division 09 - Painting, except as noted below.

B. Any electrical item factory painted that has a damaged or abraded area shall be touched-up to match surrounding finish unless it is rejected by the Architect/Engineer. Touch-up painting shall be done by Division 26 subcontractor at the expense of the electrical contractor.

C. Provide prime and finish painting of all exposed conduit and wireway not being painted by General Contractor.

1.13 EXCAVATION AND BACKFILL:

A. Excavation and backfill for raceway trenches shall be performed under Division 26.

B. Site excavation and backfilling shall comply with the requirements of Division 31.

1.14 ABBREVIATIONS:

A. The following abbreviations may be found in this specification and in the drawings.

1.	A	Ampere
2.	AC	Alternating Current
3.	A/E	Architect/Engineer (Also referred to as the “Engineer”)
4.	AEIC	Association of Edison Illuminating Companies
5.	AHJ	Code Authority Having Jurisdiction
6.	ANSI	American National Standards Institutes, Inc.
7.	ASTM	American Society for Testing and Materials
8.	ASYMM	Asymmetrical
9.	AV	Audiovisual Systems
10.	AWG	American Wire Gauge
11.	C	Conduit
12.	CBM	Certified Ballast Manufacturers
13.	CFM	Cubic Feet per Minute
14.	DB or dB	Decibel
15.	DC	Direct Current
16.	EMT	Electric Metallic Tubing
17.	ETL	Electric Testing Laboratories
18.	F	Fuse or Farenheit, as applicable
19.	GFI	Ground Fault Interrupter
20.	HZ	Hertz
21.	IEEE	Institute of Electrical and Electronic Engineers
22.	IMC	Intermediate Metal Conduit
23.	KCMIL	Thousand Circular Mil
24.	KV	Kilovolt (1000-volt)
25.	KVA	Kilovolt Ampere

26.	MA	Milliampere
27.	NEC	National Electrical Code
28.	NEMA	National Electrical Manufacturers Association
29.	NFPA	National Fire Protection Association
30.	NOC	Normally Open Contact
31.	NCC	Normally Closed Contact
32.	PVC	Polyvinyl Chloride
33.	RMC or GRC	Rigid Metal Conduit
34.	RMS	Root Mean Square
35.	RNMC	Rigid Non-Metallic Conduit
36.	RS	Rapid Start
37.	SPD	Surge Protective Device
38.	SYMM	Symmetrical
39.	TVSS	Transient Voltage Suppressor System (same as “SPD”)
40.	UL	Underwriters' Laboratories, Inc.

PART 2 - PRODUCTS:

2.1 MATERIALS:

A. All materials used in this work shall be new unless otherwise noted. All materials used on this project shall be listed and labeled by one of the third party agencies which have been approved by the code authority having jurisdiction to safety test and label electrical and mechanical equipment. Any material installed that is not labeled shall be subject to a field evaluation by one of these approved agencies, at the contractor's expense, if requested by the authority having jurisdiction or the Engineer. Any item not approved by the agency shall be replaced by the contractor at his expense. It shall be the contractor's responsibility to verify that materials specified or used on the project are labeled.

B. Catalog numbers and trade names in these specifications and noted on the drawings are intended to describe the material, devices or apparatus wanted and not to limit competition.

C. Where "or equivalent as accepted by the Architect/Engineer" is specifically noted in the specifications, reference to any article, device, product, material, fixture, or type of construction by name, make or catalog number, such reference shall be interpreted only as establishing a standard of quality and shall not be construed as limited competition. The Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect expressed in writing is acceptable as equivalent to that specified.

D. The contractor shall immediately upon request present samples and test data from a recognized independent testing laboratory of the proposed substitute items so that the Architect's judgment may be based upon comparison of actual items rather than just catalog cuts.

E. The Architect/Engineer may request that the Contractor provide full sized model of the proposed material or assembly, at a location convenient to the Engineer/Architect for a complete

evaluation. All presentations shall be made by the Contractor's representative and not by the representative of the manufacturer of the equipment.

F. Materials from listed manufacturers shall only be acceptable if they can properly fit in the allocated spaces without interference from building walls, ceilings, piping conduit, ducts or other equipment.

G. The contractor, through the manufacturer of the equipment specified here shall review the use, details, and methods of installation of this product as indicated and shall disclose to the Architect any and all deviations from his recommended use and method of installation and shall also disclose to the Architect his recommendations for the use and method of installation of his product to achieve the intended purpose and result. Such disclosure shall be made within the time stipulated for submission of shop drawings.

PART 3 - EXECUTION

3.1 DIMENSIONS:

A. Electrical equipment, fixtures and plans are not to be scaled. Necessary dimensions shall be obtained from architectural and structural drawings. If work is being done within existing buildings or structures, verify by field measurements all dimensions and plans shown on drawings.

3.2 INSPECTIONS:

A. Contractor shall cooperate with architect/engineer during the performing of project inspections. Open and close equipment doors as required to gain access to equipment for inspection by the architect/engineer. Provide qualified electricians to assist architect/engineer during inspections.

3.3 SUPERVISION AND COORDINATION:

A. The Contractor shall have in charge of the work at all times during construction a thoroughly competent foreman with extensive experience in the work to be performed under this contract. Anyone deemed not capable by the Architect/Engineer shall be replaced immediately upon request, and after a satisfactory foreman has been assigned, he shall not be withdrawn without the written consent of the Engineer.

B. Installation of electrical conduits, boxes and equipment shall not interfere with access to HVAC and plumbing equipment, its controls or its maintenance. Likewise, electrical boxes and equipment shall be located at accessible locations complying with NEC.

C. The Contractor shall coordinate the work under his contract as to avoid conflicts between his work and the work of other trades. Contractor shall carefully examine the drawings prior to

running any conduit and shall be responsible for the proper fittings of materials and equipment into the space provided prior to installing any conduit or equipment in accordance with requirements of the National Electric Code. If any departures from the contract drawings are deemed necessary by the Contractor, detail drawings of such departures and the reasons therefore shall be submitted as soon as practicable to the Architect/Engineer for his review. No such departures shall be made without this review and written clarification or change order.

D. Submit field coordination drawings as specified in Section 26 01 00, Part 1. Requirements stated on "Fabrication Drawings" paragraph of Section 26 01 00 shall apply. These drawings are intended to reflect actual installation of mechanical and electrical systems. Electrical items interfering with work under other trades shall be relocated as required to avoid conflict, at no extra cost to the Owner or its agents. No rough-in shall be accomplished until these drawings have been approved by the A/E.

E. Electrical Contractor shall cooperate with other contractors and subcontractors to allow for the installation of their work as well as his own.

F. The Electrical Contractor shall be responsible for his work fitting in place without conflict with the other trades, where proper planning could avoid interference. Any work installed by this Contractor without regard for the work of others, or if a conflict results, must be changed as directed by the Architect/Engineer without additional cost to the Owner.

G. Conduit shall be installed in a way that does not weaken, or interfere with, the structural system for the building.

H. Relocation of manholes, outlets, equipment, conduit, system connections or rough-in locations up to twenty feet, if necessary, in any direction shall be done at no additional cost to the Owner or its agents if identified as required, or communicated to the contractor, before roughing-in.

I. Coordinate with HVAC, plumbing, and fire protection contractors to prevent interference between cabletray and ductwork or piping. Whenever there is a conflict between sprinkler piping and cable tray, the electrical contractor shall, at no extra cost to the owner, relocate cable tray to avoid conflict with pipe or ductwork.

J. Coordinate with HVAC, Plumbing and Fire Protection Contractors to assure that no pipe or duct is run above panelboard or switchboard, prior to the installation of this equipment, except as otherwise noted. Piping that is unavoidable shall only be permitted if it allows for clear 6'-0" space above the equipment after being protected with drip pan that shall be provided by this contractor. Inform Architect/Engineer of any case where there is conflict.

K. The contractor shall verify that the electrical equipment to be installed fits in the assigned space prior to running any conduit or installing the equipment. Any potential conflict shall be brought to the attention of the A/E at once.

L. The Architect/Engineer reserves the right of observing all concealed work, before being covered. This Contractor shall notify the Architect/Engineer of the need of a job observation at least four working days prior to concealment of work.

M. Requests for information (RFI) answers provided by the A/E to contractor's RFI's do not constitute authorization to change the requirements of the contract documents. The contractor shall submit a change order request for consideration by A/E for any equipment, material, wiring method, or other work that as a result of the outcome of an RFI, may require changes from the original contract documents. No deviation from the original contract is authorized until the change order request is approved.

3.4 SCHEDULE OF WORK:

A. Work under Division 26 - Electrical shall be phased and scheduled to satisfy construction manager, general contractor, plumbing contractor, HVAC contractor, and fire protection contractor's approved schedule of work.

3.5 FIRE PROTECTION:

A. Do not install outlets back-to-back, regardless of what may appear to be shown on drawings. Outlets installed on opposite sides of same wall shall be installed not less than 12" apart as viewed on plan and 24" apart if wall is fire rated, unless suitable fireproofing protection is provided to satisfy AHJ.

B. Provide additional fire proofing, either by spray-on fire proofing type method, by applying gypsum board layers, or by any other approved method, as required to maintain fire rating of overhead slabs where floor boxes are to be installed to satisfy requirements of the building code authority having jurisdiction.

3.6 CUTTING AND PATCHING:

A. This Contractor shall do all cutting and patching necessary for the proper installation of his work and shall repair any damage done by himself or his workmen.

B. Required excavation for installation of all electrical work shall be provided by the electrical contractor and replacement and compaction shall be performed according to other specifications relating to the particular type of work.

3.7 WASTE MATERIALS:

A. The Contractor shall at all times keep the premises free from accumulation of waste materials or rubbish caused by his employees or work and shall cleanup scraps and seep floors each day

workers are at the job site. At the completion of the work he shall remove all leftover materials, equipment and debris resulting from the work done under this Division.

B. Waste that is classified by law, state or Federal agencies as hazardous or toxic, like fluorescent lamps, ballasts, or other equipment containing PCB's, shall be discarded through bonded hazardous waste disposal facilities utilizing methods prescribed by law.

3.8 TESTS:

A. Refer to Section 260235 – Electrical Testing.

3.9 NOISE AND VIBRATION CONTROL:

A. Certain parts of the electrical system shall be provided with noise and vibration control as specified in Section 260140. In case of conflict between this section requirements and requirements of other Division 26 sections, Section 26 01 40 requirements shall prevail.

3.10 FIREPROOFING:

A. It is the responsibility of this contractor to provide all additional fire proofing required to maintain the fire resistance integrity and rating of floors, walls and ceilings that may be compromised by the installation of conduits, raceways, boxes and electrical cabinets.

3.11 COORDINATION WITH POWER COMPANY:

A. Contractor is responsible for coordinating power delivery to building with Power Company, and providing conduit, pads and metering provisions required to obtain Power Service including but not limited to the following tasks:

1. Submitting power load information utilizing load tabulation shown on drawings.
2. Serving as Owner's agent in the request for power delivery.
3. Coordinating with power company on routing of primary cables and requirements for primary conduit, grounding, concrete pads, and metering which shall be provided as part of this contract.
4. Scheduling work with Power Company.

END OF SECTION 26 01 00

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SECTION 26 01 11 - ELECTRICAL OUTLINE OF WORK

PART 1 - GENERAL

1.1 NOTE:

A. Validate with Construction Manager the Division of Work described here prior to bidding project.

1.2 SITE WORK:

A. Electrical site work shall include all work that is specified as part of Divisions 26 and 28 including, but not necessarily limited to:

1. Underground 480/277 volts power service from Power Company transformer to new building.
2. Exterior lighting
3. Supervised fire alarm signal wiring for backflow preventers
4. Power Company transformer concrete pads and metering provisions.
5. Additional work as specified and shown on drawings.

1.3 BUILDING WORK:

A. Electrical building work shall include all work that is specified as part of Divisions 26 and 28 including, but not necessarily limited to:

B. General Requirements: The following is an outline of the systems intended to comprise the electrical interior work. Refer to the entire construction documents for complete requirements.

1. 480/277 volts, 3-phase, 4-wire underground service
2. Surge Protection Devices (“SPD”), also referred to as “TVSS” devices.
3. Distribution panelboards
4. Lighting and receptacle panelboards
5. Dry type transformers
6. Feeder circuits, including conduits, conductors, troughs, boxes and fittings
7. Branch circuits, including conduits, conductors, outlets, boxes, receptacles, switches and fittings
8. Lighting fixtures
9. Occupancy sensing automatic light switching system
10. Lighting control system with relay panel.
11. Equipment tests

12. Wiring devices and coverplates

13. Grounding systems

14. Safety switches

15. Power connection to all equipment requiring electrical power supply

16. Raceway system for TV Surveillance (CCTV), access control, and voice and data network wiring systems.

17. Self-contained battery light fixtures for emergency lighting.

18. Fire alarm system.

C. The following work is specified under Division 28:

1. Spec Section 28 31 00 – Fire Alarm and Smoke Detection System

1.4 WORK RELATED TO DIVISION 28:

A. In addition to the above described work, provide as part of Division 26 all conduit, raceway, pull cord, outlet boxes, grounding provisions and line power (120V, 60 Hz) supply required for the installation of the following systems specified under Division 28 and for those specialty items being provided by the Owner as indicated on the following schedule:

SPECIAL SYSTEMS CONSTRUCTION RESPONSIBILITY MATRIX					
SYSTEM	FURNISHED BY	INSTALLED BY	PATH-WAYS PROVIDED BY	120 VOLTS LINE VOLTAGE POWER SUPPLY (*) PROVIDED BY	SPECIFIED IN SECTION
Data Wiring	Owner	Owner	Div. 26	Div. 26	
Telephone Wiring & System	Owner	Owner	Div. 26	Div. 26	
Card Access	Owner	Owner	Div. 26	Div. 26	
Fire Alarm System	Contractor	Contractor	Div. 26	Div. 26	28 31 00
Surveillance TV Cameras	Owner	Owner	Div. 26	Div. 26	
Audiovisual Systems	AV System Contractor / Owner	AV System Contractor / Owner	Div. 26	Div. 26	

(*) Line Voltage Power Supply: 120V, 60Hz circuits, including power connections and NEMA 5-20R receptacles required by each system for operation.

END OF SECTION 26 01 11

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. NOTE: Validate with Construction Manager the Division of Work described here prior to bidding project.

B. This section delineates the DIVISION OF WORK between Divisions 21, 22, 23, 26 and 28.

1.2 DIVISION OF WORK BETWEEN DIVISION 23 AND DIVISION 26:

A. All individual motor starters for mechanical equipment (fans, pumps, etc.), shall be furnished and installed under Division 23.

B. Under Division 26, power wiring rough-in shall be provided from junction box, trough, starter or disconnect switch, as required by the specific piece of equipment. Equipment final connections shall be provided under Division 26.

C. Mechanical equipment with built-in disconnects provided under Division 23 shall be wired under Division 26 to the disconnect. HVAC equipment without built-in disconnect switches will be provided with separate disconnect switch under Division 26. Wiring from the switch to the equipment shall be under Division 26.

D. Duct smoke detectors shall be furnished by Division 28, installed by Division 23, and wired under Division 28. Fire alarm AHU shut down control circuits shall be wired from a Division 28 fire alarm control relay to AHU equipment controller under Division 23. Coordinate with Division 23 contractor for location of relays.

E. All other relays, actuators, timers, seven-day clocks, motorized dampers, alternators, pressure, vacuum, float, flow, pneumatic-electric, and electric-pneumatic switches, aquastats, freezestats, line and low voltage thermostats, thermals, remote selector switches, remote push-button stations, emergency break-glass stations and interlocking wiring and appurtenances required by equipment or systems under Division 23 shall be furnished, installed and wired under Division 23.

F. All wiring required for controls and instrumentation not indicated on the Division 26 drawings shall be furnished and installed by Division 23.

G. Additional power wiring required for HVAC equipment over and above what the electrical contractor is required to provide in accordance with the electrical drawings shall be provided by the HVAC contractor.

1.3 DIVISION OF WORK BETWEEN DIVISION 21, 22 AND DIVISION 26:

A. The same rules described for Division of Work between Divisions 23/26 apply to Division of Work between Divisions 21, 22, and Division 26.

END OF SECTION 26 01 26

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SECTION 26 01 34 - ELECTRICAL CONNECTIONS

PART 1 - GENERAL

1.1 SCOPE

A. Refer to Section 26 01 26 and electrical drawings for electrical connections to Divisions 21, 22, and 23 equipment.

B. Power connections to equipment that is not part of Divisions 21, 22 AND 23 shall be provided under Division 26.

1.2 EQUIPMENT CONNECTIONS:

A. CONTROL WIRING: Control wiring for equipment not provided under Division 26 - Electrical unless specifically called for on the electrical drawings will be provided by the respective equipment contractor. Refer to Section 26 01 26 for HVAC contract control wiring.

PART 2 - PRODUCTS:

2.1 DISCONNECT SWITCHES:

A. Disconnect switches for single phase motors through 1/2 horsepower shall be 20-ampere AC rated toggle switches. Disconnect switches for motors larger than 1/2 horsepower shall be fused switches.

B. Disconnect switches for 3-phase motors and heating loads shall be fused knife type safety switches, as specified in Section 26 28 16. Disconnect switches for motors shall be horsepower rated to match or exceed the rating of motor.

PART 3 - EXECUTION

3.1 RACEWAY CONNECTIONS:

A. Equipment connections shall be made through raceway as previously specified except that connections to motor and appliances in other than return air plenums shall be through liquid tight flexible metal conduit with grounding conductor, as applicable. Use regular flexible metallic conduit in spaces above ceilings used as return air plenums. Flexible conduit connections, other than as otherwise specified in Sections 26 05 31 and 26 50 00, shall be not less than 12 inches but not more than 36 inches in length.

3.2 COORDINATION:

A. It shall be the responsibility of the Electrical Contractor to verify adequacy of supply wiring, overcurrent protection, proper voltage, phase rotation, maximum temperature rating of branch circuit conductor, and final location of the equipment provided by the Owner and under other sections of these specifications prior to the running of any conduit or wiring. Report to the Architect/Engineer any discrepancy or mismatch between equipment being connected and incoming branch circuit or feeder.

END OF SECTION 26 01 34

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SECTION 26 01 40 - NOISE AND VIBRATION CONTROL FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this section.

1.2 WORK INCLUDED:

A. Vibration Isolation
B. Sealing Around Penetrations through Walls and Slabs
C. Sealant
D. Installation of flexible conduit between non-isolated construction and isolated construction, including mechanical equipment, fans, pumps, and bridging between isolated room-within-a-room and non-isolated adjacent construction.

1.3 RELATED WORK SPECIFIED ELSEWHERE:

A. Consult all other Sections to determine the extent of work specified elsewhere but related to this Section. This work shall be properly coordinated to produce an installation satisfactory to the Owner.

1. Installation of Transformers
2. Electric Service Distribution
3. Concrete Housekeeping Pads
4. General Lighting Systems
5. Section 26 05 48 – Vibration and Seismic Controls for Electrical Systems

1.4 DEFINITIONS:

A. The term "or as approved" means the contractor may propose an alternate product, but the Architect’s consultant shall be sole judge of acceptability of alternate products. The term "Contractor" as used in this Section refers to that contractor directly responsible for the supply and installation of the Electrical Systems, including noise and vibration control.

1.5 CONTRACTOR'S RESPONSIBILITY:

A. The Electrical Contractor shall be directly responsible for the supply and installation of noise and vibration control equipment and work for the Electrical Systems.

B. The Contractor shall be responsible for providing a complete and suitable installation of isolation equipment to meet the intent of this specification. The Contractor, even if not specifically mentioned herein or on the drawings, shall supply any additional equipment needed to meet the intent of this specification, without claim for additional payment.

C. Performance or waiving of inspection, testing or surveillance for any portion of the Work shall not relieve the Contractor of the responsibility to conform strictly with the Contract Documents. The Contractor shall not construe performance or waiving of inspection, testing or surveillance by the Owner or Architects to relieve the Contractor from total responsibility to perform in strict accordance with the Contract Documents.

1.6 MANUFACTURER'S RESPONSIBILITIES:

A. Manufacturer of vibration isolation equipment shall have the following responsibilities:

1. Determine vibration isolation for all equipment and systems in accordance with all codes and authorities having jurisdiction on this project.

2. Provide equipment isolation systems as scheduled or specified.

3. Guarantee specified isolation system deflection.

4. Provide installation instructions, drawings and field supervision to assure proper installation and performance.

5. The vibration isolation systems shall be guaranteed to have deflection as specified. The mounting manufacturer shall determine mounting sizes, and the sizes shall be installed in accordance with the manufacturer's instructions.

6. The vibration isolator vendor shall ensure that all equipment to be isolated has sufficient support structure to distribute equipment loads onto isolators. Where additional support structure is required, vibration isolator vendor shall provide this.

1.7 APPROVED MANUFACTURERS:

A. A single manufacturer who has supplied isolation equipment for at least five years shall furnish all noise and vibration control apparatus. The vendor shall design and provide all hangers, isolators, bases, pads, sleeves and other devices specified, required, or detailed for the vibration isolation of all electrical equipment and conduit. The vendor for vibration control equipment shall be one of the following, or as approved:

1. Mason Industries Inc.
2. Amber-Booth
3. Kinetics Noise Control

1.8 SHOP DRAWINGS:

A. The contractor shall submit fully coordinated shop drawings for all vibration and noise control equipment for review by the Architect’s consultant. These submittals shall state the performance of the noise and vibration control products to be provided, such as, but not limited to, the following: vibration isolator model or type, size and static deflection; isolator location shown on an outline of the isolated equipment; installation details; locations of isolated conduit hangers on conduit layout plans; materials and details for penetrations, including penetrations by groups of conduits, and locations of acoustically sealed pull boxes.

1.9 DESCRIPTION OF SYSTEMS:

A. VIBRATION ISOLATION:

1. Vibration isolators shall be installed to attenuate the vibration transfer from equipment such as transformers to reduce vibration.

2. Flexible connections shall also be supplied for conduit and wiring serving electrical equipment on vibration isolators to ensure complete isolation of such equipment.

B. TRANSFORMERS:

1. Transformers shall be located approximately where shown on the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. FOAM ROD: Foam backer rod shall be closed cell polyethylene suitable for use as a backing for non-hardening sealant.

B. NON-HARDENING SEALANT:

1. Sealant for electrical penetrations shall be non-hardening polysulphide type.

2. Permanently flexible, approved firestop putty may be used in lieu of the sealant on foam rod in noise sensitive walls that are also fire rated.

2.2 EQUIPMENT:

A. All equipment provided for vibration isolation shall be new and manufactured specifically for the purpose intended.

2.3 VIBRATION ISOLATORS:

A. The static deflection of isolators shall be as given in the equipment schedule and specified below.

B. Vibration isolator sizes and layout shall be determined by the vibration isolator supplier to meet performance criteria below. Static deflections specified shall be met with equipment fully operational.

C. ISOLATOR TYPE WP:

1. Type WP (Waffle Pads) shall be minimum 5/16 inch thick neoprene pads ribbed or waffled on both sides.

2. The pads shall be selected for 15% strain. Neoprene shall be bridge-bearing quality with a maximum durometer of 50. Where required to meet this strain criterion, steel load-spreading plates shall be incorporated between the equipment and the neoprene pad. If the isolator is bolted to the structure, a neoprene vibration isolation washer and sleeve (Uniroyal Type 620/660 or as approved) shall be installed under the bolt head between the steel washer and the base plate.

3. (Type WP: Mason Industries Type W, Super W, or as approved.)

D. ISOLATOR TYPE MWP:

1. Type MWP (Metal and Waffle Sandwich Pads) shall consist of two 5/16 inch thick ribbed or waffle neoprene pads sandwiching a 16 ga stainless steel plate. The pad shall be designed for 15% strain. Neoprene shall be bridge-bearing quality with a maximum durometer of 50. If the isolator is bolted to the structure, a neoprene vibration isolation washer and sleeve (Uniroyal Type 620/660 or as

approved) shall be installed under the bolt head between the steel washer and the base plate.

2. (Type MWP: Mason Industries Type WSW or as approved.)

E. ISOLATOR TYPE NIS:

1. Type NIS isolators shall be designed with a neoprene element to provide isolation in tension, shear or compression. Neoprene shall be bridge bearing quality with a maximum durometer of 30.

2. (Type NIS: Mason Industries Type RBA or as approved.)

F. ISOLATOR TYPE DDNM:

1. Type DDNM (Double Deflection Neoprene Mounts) shall be laterally stable, double deflecting, molded neoprene isolators. All metal surfaces shall be covered with neoprene. The top and bottom surfaces shall be ribbed, and bolt holes shall be provided in the base. The mounts shall have leveling bolts rigidly secured to the equipment. The strain on the neoprene shall not exceed 15%. Neoprene shall be bridge bearing quality with a maximum durometer of 50. DDNM mounts shall be selected for a static deflection of 0.25 inches unless otherwise specified.

2. (Type DDNM: Mason Industries Type ND or as approved.)

G. ISOLATOR TYPE DDNH:

1. Type DDNH (Double Deflection Neoprene Hangers) shall consist of a molded neoprene element in a steel hanger box. A neoprene sleeve shall be located where the lower hanger rod passes through the steel box supporting the isolator, such that the hanger rod cannot contact the steel hanger body. The diameter of the clear hole in the mounting box shall be at least 3/4 inch larger than the diameter of the hanger rod and permit the hanger rod to swing through a 30 degree arc. When installed, the hanger box shall be allowed to rotate through a full 360 degree arc without encountering any obstructions.

2. Unless otherwise specified, the static deflection of DDNH hangers shall be 0.25 inches with a strain not exceeding 15%. Neoprene shall be bridge-bearing quality with a maximum durometer of 50.

3. (Type DDNH: Mason Industries Type HD or as approved.)

H. ISOLATOR TYPE SPNM:

1. Type SPNM (Spring and Neoprene Mounts) shall be free standing and laterally stable without any housing. Springs shall be designed so that the ratio of the horizontal to vertical spring constant is between one and two. The spring diameter shall be not less than 80% of the compressed height of the spring at rated load. Loaded springs shall have a minimum additional travel to solid equal to 50% of the specified static deflection.

2. Unless otherwise specified, the minimum static deflection of SPNM isolators for equipment mounted on grade slabs shall be 1 inch, and the minimum static deflection for equipment mounted above grade level shall be 2 inches.

3. Two Type WP isolation pads sandwiching a 16 ga stainless or galvanized steel separator plate shall be bonded to the isolator base plate.

4. Unless otherwise specified, isolators need not be bolted to the floor for indoor installations. If the base plates are bolted to the structure, a neoprene vibration isolation washer and sleeve (Uniroyal Type 620/660 or as approved) shall be installed under the bolt head between the steel washer and the base plate.

5. (Type SPNM: Mason Industries Type SLFSW or as approved.)

I. ISOLATOR TYPE SPNH:

1. Type SPNH (Spring and Neoprene Hangers) shall consist of a steel spring in series with a neoprene element. The spring shall have a minimum additional travel to solid equal to 50% of the specified deflection. The neoprene element shall have a static deflection of not less than 0.3 inches with a strain not exceeding 15%. Neoprene shall be bridge-bearing quality with a maximum durometer of 50.

2. Unless otherwise specified, the static deflection of SPNH hangers shall be 2 inches.

3. Spring diameter and hanger box hole size shall be large enough to permit the hanger rod to swing through a 30 degree arc. A neoprene sleeve shall be inserted in the steel hanger box where the lower hanger rod passes through it, such that the hanger rod cannot contact the steel hanger body. The diameter of the clear hole in the mounting box shall be at least 3/4 inch larger than the diameter of the hanger rod. When installed, the spring element shall not be cocked, and the hanger box shall be allowed to rotate through a full 360 degree arc without compromising a minimum clearance of 1 inch.

4. (Type SPNH: Mason Industries Type 30N or as approved.)

2.4 NEOPRENE MOUNTING SLEEVES:

A. Neoprene mounting sleeves for hold-down applications of equipment with vibration isolators shall be Uniroyal Type 620/660 or as approved.

PART 3 - EXECUTION

3.1 GENERAL:

A. Ballasts, relays, dimmers, equipment controls and all transformers shall be located as shown on the drawings. If not shown, location is subject to review by architect and acoustical consultant prior to installation. Under no circumstances shall such devices be located within noise critical spaces or on walls, slabs or ceilings that are common to such spaces.

3.2 TRANSFORMERS:

A. All transformers shall be installed on Type DDNM or DDNH isolators. Wiring connections to a transformer supported on Type DDNM or Type DDNH isolators shall be made with a slack U-shaped flexible conduit or as otherwise approved.

B. Transformers shall not be hung from or supported on other equipment, pipes or ductwork installed on vibration isolators, but shall be supported on or suspended from building structure.

3.3 MOTORS AND ELECTRICAL EQUIPMENT:

A. All wiring connections to motors and electrical equipment supported on Type SPNM or Type SPNH isolators shall be made with a slack U-shaped section of flexible conduit. Wiring connections to motors and electrical equipment supported on Type DDNM and or Type DDNH isolators shall be made with a slack U-shaped flexible conduit. Flexible conduit and cable shall be capable of and recommended for such curvature.

3.4 ELECTRICAL EQUIPMENT ENCLOSURES:

A. Electrical equipment enclosures containing relays, contactors, small transformers or choke coils shall be mounted on Type NIS isolators. Wiring conduits to this equipment require no resilient connections or special isolation.

3.5 PENETRATIONS OF WALLS AND SLABS:

A. All conduit, cable tray and cable penetrations through electrical or mechanical room walls containing transformers shall be sleeved, packed and caulked airtight.

B. Where conduit crosses a building expansion joint or acoustic joint, an 18” length of flexible conduit shall be used to bridge between the two constructions. Rigid conduit shall not be acceptable.

3.6 FIELD QUALITY:

A. Contractor shall work in accord with best trade practices, shall fabricate and install all items in accordance with manufacturer's recommendations and Architect's directions, and shall consult and coordinate with trades doing adjoining work in order to provide an installation of first class quality.

3.7 TESTING AND ADJUSTMENT:

A. Contractor shall test and adjust noise and vibration control products and installations to achieve specified performance.

3.8 SITE ACCESS:

A. During installation of equipment, Contractor shall arrange for access as necessary for inspection of isolation and noise control equipment by Architect.

3.9 INSPECTION:

A. Upon completing installation and adjustment for suitable operation of all work specified under this section, the Contractor shall notify in writing the Architect, who will schedule for

conformance. The letter shall certify that all work specified under this section is complete, operational and adjusted in every respect, and that all work is ready for the completion checkout. Defective equipment and installation shall be repaired at the cost of the Contractor, and another inspection shall be scheduled.

B. For each inspection, workmen shall be furnished to perform such functions as are necessary for inspection of the equipment.

3.10 COMMISSIONING:

A. This contractor, and the manufacturer of the equipment and materials specified in this section, shall provide the labor, materials, equipment, services and support required by the project commissioning agent to accomplish the successful commissioning of the equipment and systems specified here.

END OF SECTION 26 01 40

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PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Provide testing of electrical wiring and systems as specified here.

B. Provide the following tests:

1. Feeder insulation resistance testing
2. Ground system testing
3. Circuit breaker tests
4. Other tests as specified in other sections of this specification

1.2 DOCUMENTATION:

A. All tests specified shall be completely documented indicating time of day, date, temperature and all pertinent test information.

B. All required documentation of readings indicated above shall be submitted to the engineer prior to, and as one of the pre-requisites for final acceptance of the project.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION:

3.1 FEEDER INSULATION RESISTANCE TESTING:

A. All current carrying phase conductors and neutrals shall be tested as installed, and before connections are made, for insulation resistance and accidental grounds. This shall be done with a 500-volt megger. The procedures listed below shall be as follows:

1. Minimum readings shall be one million (1,000,000) or more ohms for #6 wire and smaller, 250,000 ohms or more for #4 wire or larger, between conductors and between conductor and the grounding conductor.

2. After all fixtures, devices and equipment are installed and all connections completed to each panel, the contractor shall disconnect the neutral feeder conductor from the neutral bar and take a megger reading between the neutral bar and the grounded enclosure. If this reading is less than 250,000 ohms, the contractor shall disconnect the branch circuit neutral wires from this neutral bar. He shall then test each one separately to the panel and until the low readings are found. The contractor shall correct troubles, reconnect and retest until at least 250,000 ohms from the neutral bar to the grounded panel can be achieved with only the neutral feeder disconnected.

3. At final inspection, the contractor shall furnish a megger and show the engineers and Owner representatives that the panels comply with the above requirements. He shall also furnish a hook-on type ammeter and a voltmeter and take current and voltage readings as directed by the representatives.

3.2 GROUND SYSTEM TESTING:

A. Upon completion of installation of the electrical grounding and bonding systems, test the ground resistance with a ground resistance tester. Where tests show resistance-to-ground is over 25 ohms, take appropriate action to reduce the resistance to 5 ohms, or less, by driving additional ground rods. Then retest to demonstrate compliance. Submit test report to Owner representative.

B. Ground Resistance Tests:

1. Resistance to ground of all made grounding electrodes and grounding rods shall be determined through ground resistance tests. The tests shall provide a true overall measurement of the resistance to ground, and of the entire physical integrity of the system.

2. Ground resistance tests shall be made in dry weather and in no case less than 48 hours after rainfall. Tests shall be conducted using the ratio method which measures the ratio of the resistance to earth on an auxiliary electrode. All measurements shall be in accordance with the Institute of Electrical and Electronic Engineers, Inc., Publication No. 550, dated May 1949, “Master Test Code for Resistance Measurement”, Paragraph 3.43 - ration ohmmeter and as herein specified.

3. The indicating instrument shall be self-contained and shall include a direct current generator, synchronized current and potential reverse, cross current and potential coils, direct reading ohmmeter, series resistors, and range selector switch. The direct reading ohmmeter shall be calibrated for ranges of 0 to 20 and 0 to 200 OHMS on a scale logarithmic in character.

4. Associated Research, Inc. Vibroground instrument is acceptable.

5. The auxiliary grounding electrodes shall be placed in accordance with instrument manufacturer’s recommendations but not less than 50 feet apart in accordance with manufacturer’s recommendations.

C. Record of Ground Resistance Tests:

1. A certified record of ground resistance tests on the entire system shall be prepared and submitted for a compliance to the Architect/Engineer and to the Owner upon completion of the tests.

2. The record shall include the number of rods driven, their depth at each location, and verification of ground continuity at each joint, shall be prepared and submitted for compliance to the Architect/Engineer and to the Owner upon completion of the tests. The grounding resistance test shall be performed by an independent testing company, engaged by the contractor, with not less than five years of experience in this type of work. The name of the testing company, along with its credentials shall be submitted to the Owner’s representative with the contract bid.

3.3 CIRCUIT BREAKER TESTS:

A. The following tests shall be performed all feeder and service circuit breakers that are provided with ground fault protection. Testing shall be performed by a qualified factory technician at the job site. Refer to Sections 26 24 13 for additional requirements. All

readings shall be tabulated:

1. Phase tripping tolerance (within 20% of UL requirements).
2. Trip time (per phase) in seconds
3. Instantaneous trips (amps) per phase
4. Insulation resistance (in megaohms) at 100 volts (phase to phase, and line to load)
5. Ground fault protection, if protection is provided.

END OF SECTION 26 02 35

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SECTION 26 05 19 – LOW VOLTAGE ELECTRICAL CONDUCTORS

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. This Section applies to secondary power and signaling conductors for systems rated 600 volts and below.

1. A complete system of conductors shall be installed in the raceway systems as specified here and shown on drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 26 02 35 Electrical Testing

1.3 APPLICABLE SPECIFICATIONS AND STANDARDS:

A. Compliance: The materials specified here shall meet the following specifications and standards in their current edition.

B. UL Standards:

1. Insulation tape
2. Wire Connectors and Soldering lugs

C. NEMA Standards:

1. Thermoplastic - Insulated WC 70 (ICEA S-95-658-1999)

1.4 GENERAL:

A. All wire and cable shall be listed by an "approved" third party testing agency.

B. Prior to energizing; feeders, sub-feeders and service conductor cables shall be tested for electrical continuity and short circuits. A copy of these tests shall be sent to the State Construction Office, to the Owner and the Architect/Engineer.

C. All wire and cable shall be run in raceway.

PART 2 - PRODUCTS

2.1 CONDUCTORS:

A. All conductors shall be made of copper.

B. Conductors, unless otherwise noted, shall be heat and moisture resistant grade, thermoplastic insulated. Conductors No. 8 AWG and larger shall be stranded Class B copper conductors. Conductors No. 10 and smaller shall be solid copper. Conductors, sizes #6 and smaller, shall have THHN-THWN insulation; conductors, #4 and larger, shall have XHHW insulation. Branch circuit conductors for all other lighting fixtures shall have a temperature rating of not less than what is required by the UL listing of the fixture with a minimum rating of 90 degrees C.

C. Except as otherwise noted on technical specification sections, conductors for signal and control circuits above 50 volts AC shall be stranded type, THWN-THHN as permitted by NEC, No. 14 AWG. Conductors for signal and control circuits below 50 volts AC or DC may be 300-volt, PVC insulated, stranded No. 16 AWG, unless otherwise noted on corresponding technical section.

D. Branch circuit conductors shall be not smaller than No. 12 AWG, except as noted here or on the drawings. Conductors for branch circuits whose length from panel to the first outlet in the circuit of load exceeds 75 feet for the 280/120 volt system shall not be smaller than No. 10 AWG from the panel to the first outlet box in the circuit, but not smaller than what is scheduled on panelboard schedule and No. 10 AWG for 480/277 volt system conductors when the length is longer than 200 feet.

E. Conductors being connected to transformers and other equipment shall have a temperature rating as required by the transformer or equipment manufacturer.

2.2 COLOR CODING:

A. Conductors, feeders, and branch circuits shall be color coded by phases as follows:

1. 208/120 volts systems: Phase A-black; Phase B-red; Phase C-blue; neutral-white; Grounding wire-green.

2. 480/277 volts systems: Phase A-brown; Phase B-Orange; Phase C-Yellow; Neutral-Natural White, unless otherwise dictated by local county inspector.

B. Insulating tape of proper color shall be used to identify the phase conductors No. 4 AWG and larger conductors. Conductors #6 AWG and smaller shall be factory color coded.

C. Insulating tape of proper color shall be used to identify the phase conductors No. 4 AWG and larger conductors. Conductors #6 AWG and smaller shall be factory color coded.

PART 3 - EXECUTION:

3.1 BRANCH CIRCUIT NEUTRAL CONDUCTORS:

A. Each 120 and 277 volts circuit shall be provided with separate dedicated, neutral conductor.

3.2 SPLICES:

A. Solid Conductor Splices:

1. Solid conductors shall be spliced by means of Ideal 'wirenuts', 3M Company's 'Scotchlok' or T&B's 'Piggy' connectors in junction boxes and light fixtures.

2. "Sta-Kon" or other permanent type crimp connectors shall not be used for branch circuit connecting

B. Stranded Conductor Splices:

1. Namely #8 AWG and larger, shall be spliced by approved mechanical connectors plus gum rubber tape or friction tape. Solderless mechanical connectors, for

splices and taps provided with U.L. approval insulating covers, may be used instead of mechanical connectors plus tape.

3.3 INSTALLATION OF CONDUCTORS:

A. Conductors shall be continuous from outlet to outlet, and no splices shall be made except within outlet or junction boxes, troughs and gutters. Pull boxes may be utilized where required. If other than long radius bends are required, pull boxes sized in accordance with the NEC shall be used. Location of feeder pull boxes shall be subject to approval by A/E.

B. Do not run more than 3 single-phase circuits in each conduit, or not more than one 3-phase circuit, unless otherwise noted on drawings.

C. Do not run circuits of different voltage in same conduit.

D. Conductors in vertical runs shall be supported as required by NEC 300-19.

3.4 CONDUCTOR SEQUENCE AND ROTATION:

A. All feeders, sub-feeds to panels, motors, etc., shall be completely phased out as to sequence and rotation. Phase sequence shall be A-B-C from front to rear, top to bottom, left to right when facing equipment. Carefully check and assure that engine generator set has the same rotation.

3.5 CONNECTION OF OVERSIZED CONDUCTORS TO CIRCUIT BREAKERS AND SWITCHES:

A. When oversized branch circuit conductors are scheduled to be connected to circuit breakers, or switches, not having the capability to accept the larger conductor, provide splice in suitable junction box as close as possible to circuit breaker, as approved by the A/E, and connect to circuit breaker with the largest conductor that fit the circuit breaker. For similar situations for feeder, or large branch circuits, (circuit breakers rated 125 amperes and larger) provide lugs as required by feeder conductors.

END OF SECTION 26 05 19

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SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL:

1.1 SCOPE:

A. Grounding and bonding of the electrical system.

1.2 RELATED SECTIONS:

A. Section 26 02 35 - Electrical Testing

B. Section 26 05 19 - Low Voltage Electrical Conductors

1.3 GENERAL:

A. The power distribution system shall be grounded at each voltage level. The conduit and neutral conductors of the wiring systems and all electrical equipment shall be grounded. The ground connection of the electrical system neutral and conduit system shall be made at the main service switchboard or main power device.

B. Each conductive, non-current carrying, part of the electrical system shall be bonded to an equipment grounding conductor sized in accordance with NEC.

C. The raceway system shall not be relied on for ground continuity. A green grounding conductor, properly sized per NEC Table 250-122, shall be run in all raceways to ground each conductive, non-current carrying part of the electrical system. Exceptions are as follows:

1. Raceways for telecommunications.
2. Raceways for data.
3. Raceways for audiovisual conductors.

D. Transformer Grounding Requirements: The electrical service for each building and structure shall be grounded by four (4) means: (In accordance with Article 250 of NEC and as follows):

1. To the cold water main, if metallic and in direct contact with the earth for at least 10 feet as per NEC Article 250-50.

2. To the steel frame of the building, provided the building is effectively grounded.

3. The steel rebar of the foundation.

4. To six (6) ground rods. Ground rods shall be 10 feet long and 3/4 inches in diameter, and shall be of copper-clad steel construction. All ground connections shall be accessible for post-testing and observation by the use of grounding “wells” made of suitable site handholes or boxes.

E. A "THHN", "THWN", or "XHHW" copper ground conductor sized in accordance with the NEC shall be extended in appropriate raceway from the main service equipment and bonded to form the grounding electrode system required by Article 250-50 of the NEC. Connection to the water pipe shall be made by suitable ground clamp or by lug

connection to a plugged tee. If flanged pipes are encountered, connection shall be made with the lug bolted to the supply side of the flange connection. Electrical bond shall be established around the water meter. A stamped metal tap with the inscription "Do not Disconnect" shall be provided at the connection to the water pipe.

PART 2 - PRODUCTS

2.1 GENERAL:

A. All products shall be new and listed for the use intended.

B. Grounding rods shall be 10 feet long by ¾-inch in diameter, copperclad or copperweld.

C. Equipment grounding conductors shall be colored green and shall have 600 volt insulation and shall be as specified in Section 26 05 19.

D. Grounding conductors, where insulated, shall be colored solid green. Conductors intended as neutral shall be colored solid white on 120/208V circuits and natural gray on 277/480V circuits.

E. Minimum size grounding electrode conductor shall be #4 AWG, solid.

F. Bus Bonding Conductor Terminations:

1. Acceptable Manufacturers: Thomas and Betts, ILSCO, or approved equal.

2. Acceptable materials:

a. Two hole compression lugs: Thomas and Betts, listed “Two Hole Lugs Long Barrel Type” color code blue (example catalogue No. 54816BE), high conductivity wrought copper, electro tin plated, or approved equal, for all connection to “TMGB” and “TBB” connections.

b. One hole compression lugs: Thomas and Betts, “Long Barrel One Hole Lugs” color code blue (example catalogue No. 54905BE), high conductivity wrought copper, electro tin plated, or approved equal, are acceptable for connection of branches to “TGB.”

PART 3 - EXECUTION:

3.1 GENERAL

A. Dry type transformers and separately derived power systems shall be grounded to the nearest effectively grounded water pipe and building steel in accordance with Article 250.

B. Grounding rods and interconnecting grounding conductors shall be buried, 30 inches below grade, minimum.

C. Connection to grounding rods and to structural steel and rebar grounding electrodes shall be by the exothermic method utilizing Cadweld connections.

D. The ground resistance of any "made" electrode shall be measured by an earth megger device and it shall be 25 ohms or less as per NEC 250-56.

E. A copy of the service ground resistance test shall be sent to the design engineer and the officer in charge of construction. The test shall be signed, dated, and certified by tester.

F. Boxes with concentric, eccentric or oversized knockouts shall be provided with bonding bushings and jumpers. The jumper shall be sized per NEC Table 250-66 and lugged to the box.

3.2 BONDING OF BUILDING SECTIONS:

A. Building sections that are part of the same building shall be bonded together to form an effective path to the main service grounding electrode by using 500 KCMiL copper insulated cable. Cable run in return air plenum spaces shall be run in metallic conduit.

END OF SECTION 26 05 26

SECTION 26 05 29 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Work Included: Work under this Section includes but is not necessarily limited to the following:

1. Supports and fastenings required for properly mounting of boxes, raceways, electrical equipment and fixtures.

B. Electrical raceways, equipment and fixtures shall include the following items to the extent required on plans or in other sections of these specifications:

1. Conduit and boxes
2. Lighting fixtures
3. Dry type transformers
4. Cable trays
5. Panelboards

1.2 RELATED SECTIONS

A. Include the following sections:

1. Section 26 05 48 – Vibration and Seismic Controls for Electrical Systems

1.3 APPLICABLE PUBLICATIONS:

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.

1. Federal Specifications (Fed. Spec.)

a. RR-W-401F Wire Rope and Strand

2. American Society of Mechanical Engineers (ASME) Standards.

a. B18.2.1 Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws
b. B18.2.2 Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts

3. American Society for Testing and Materials (ASTM)

a. A307 Carbon Steel Bolts, Studs and Threaded Rod
b. A576 Steel Bars, Carbon, Hot-Wrought, Special Quality
c. F3125 High Strength Structural Bolts

4. Underwriters Laboratories, Inc., (UL) Standards

a. Building Materials Directory
b. UL57 Electric Lighting Fixtures

1.4 WIND LOAD

A. Provide supports for electrical equipment, bollards and luminaires mounted exterior to the building to withstand the rated wind hazard for the building.

B. The rated wind hazard for the building:

1. Ultimate Design Wind Speed = 120 mph
2. Serviceability Wind Speed = 90 mph
3. Exposure: C
4. Risk Category: II

C. Wind Supports Submittal: Submit as part of Division 26 work, proposed method and details to support and restrain the exterior equipment and materials listed here against wind hazard. This information shall be prepared by design engineer registered in the same state as the project site.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Steel Supports: Provide brackets, frames, and hangers fabricated from standard rolled structural steel shapes or prefabricated systems manufactured by one of the following:

1. Kindorf Electrical Products Co.
2. Powerstrut Division/Van Huffel Tube Corp.
3. Unistrut Corporation

2.2 WALL ANCHORS:

A. Interior Masonry or Concrete Walls: Expansion bolt anchors designed to match the load, seismic requirements and type wall construction, but not smaller than 3/8".

B. Exterior Precast Concrete Walls: Expansion bolt anchors with penetrations limited as approved by Architect.

C. Interior Dry Walls: Toggle bolt anchors designed to match the load and seismic requirements, but not smaller than 3/8".

2.3 BEAM ANCHORS:

A. Install expansion bolt anchors designed to match the load and seismic requirements.

B. All anchor holes drilled in reinforced concrete beams or concrete joists shall avoid cutting the reinforcing bars.

C. All heavy loads such as transformer trapeze anchors shall be reviewed with the Architect prior to installation.

D. Manufacturer of anchor bolts, toggles, etc., shall be ITT Philips (Red-Head), Ackerman Johnson, Rawlplug Co., or approved equal.

2.4 RODS:

A. Provide threaded steel rods, where required, size as required by load and seismic requirements but not less than 1/4 inch diameter. Use hot-dip galvanized steel on installation exposed to the weather. Do not use chain except where detailed or specifically required. Do not use perforated strap or wire.

2.5 BOLTS AND NUTS:

A. Squarehead bolts and heavy hexagon nuts, ANSI B18.2 and ASTM A307 or A576.

B. Bolts, underground, ASTM A325.

C. Sway brace details shall conform to all applicable requirements of MSS Pub. SP-58 cited herein.

D. Guy wires shall conform to Fed Spec. RR-W-410, as follows:

1. 5/32" diameter - Type V, Class 1
2. 3/16" to 5/16"diameter - Type V, Class 2
3. ¼" to 5/16" diameter - Type I, Class 2

E. Lighting fixtures and supports shall conform to UL 57.

PART 3 - EXECUTION:

3.1 PREPARATION:

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.

B. Prior to installation of hangers, supports, anchors, and associated work, the contractor shall meet at the project site with Construction Manager, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purposes of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.2 INSTALLATION:

A. Anchors and fasteners shall be installed in accordance with the manufacturer's directions. Necessary holes shall be drilled with drills recommended by the manufacturer and shall be of the recommended diameter and depth. The drilled holes shall be left rough, not reamed, and shall be free from any drill dust. Screws installed in wood or other material shall be so located as to be such distance away from joints as not to be loosened upon opening of joints with shrinkage of the material. Screws, bolts, nuts, or other devices used with anchors or fasteners shall have standard threads and heads and be of a type and size recommended by the manufacturer of the particular anchor or fastener being used.

3.3 RACEWAYS:

A. EMT, IMC and rigid conduit supports shall be provided at least every 8' and within 3' of each outlet box, junction box, cabinet or fitting.

B. All pipe supports shall be of type and arrangement as hereinafter specified. They shall be so arranged as to prevent excessive deflection and avoid excessive bending stresses.

C. Provide all steel and concrete required for support and anchoring of pipes other than shown on Structural or Architectural Drawings.

D. A/E shall approve method of hanging before work is started. This contractor shall bear all responsibility for materials and workmanship as described in this section and shall make sure that all hangers and supports are properly and permanently connected to building structure.

E. All supports shall be designed to avoid interference with other conduit, hangers, ductwork, building structures and equipment.

3.4 SAFE WORKING LOAD:

A. To compensate for variations in products and job conditions, anchors and fasteners, including screws, bolts, or other devices used with them, shall have a minimum safe working load of 1/4 of the holding power. The holding power of an anchor or fastener shall be based upon laboratory test and certified by the manufacturer. Safe working load may also be determined as 1/4 of a proof test load. A proof test load is a predetermined load that an anchor or fastener must support without failure. The actual holding power might be greater than the proof load.

B. The type of anchor or fastener to be used shall be designed and intended for use in the base supporting surface to which the item or support is to be attached. As a general rule, wood screws should be used on wood, masonry anchors on concrete or brick, toggle bolts or similar on hollow or thin units, and machine screws, bolts, or welded studs on steel. Some anchors and fasteners are intended for and may be used on more than 1 base material. For example, some anchors intended for concrete may apply also to hollow masonry units. Other anchor and fastening devices specifically designed for the purpose may be used for their intended application. These include concrete inserts, continuous slot channels, beam clamps, friction, and spring clamps, etc.

3.5 ATMOSPHERE:

A. Anchors and fastenings and screws, bolts, or other devices used with them, shall have corrosion resisting characteristics for the atmospheric conditions in which they are installed. When anchors and fastenings do not inherently have the necessary protection or the protection is lost during installation, they shall be coated to furnish protection sufficient for the atmosphere. If it is not possible to provide protective coatings, such anchors or fasteners shall not be used.

3.6 RESTORATION OF STRUCTURAL AND BUILDING FIREPROOFING:

A. Restore to original condition any portion of structural or building fireproofing material damaged or removed during the installation of fastener or supports.

3.7 ANCHOR BOLTS:

A. Equipment requiring seismic attachments shall be anchored to satisfy Section 26 05 48 requirements.

B. Equipment not requiring seismic attachments shall be anchored as specified here. Floor or pad mounted packaged electrical equipment shall have a minimum of 4 anchor bolts securely fastened through bases. Anchor bolts shall have straight length equal to at least 10 times the nominal diameter of the bolt and shall conform to the following table of sizes for various equipment weights.

C. Anchor bolts which exceed normal depth of equipment foundation piers or pads shall either extend into concrete floor, or the foundation shall be increased in depth to accommodate bolt lengths.

3.8 LIGHTING FIXTURES:

A. Provide fixtures and support suitable to withstand seismic disturbances without damage, as required by IBC. Support other fixtures as specified here.

1. Recessed individual or continuous row of fixtures shall be provided with fixture support wires attached to the building structural members using four wires per fixture. These support wires shall be the same type of wire as used to support lay-in ceiling track. In addition, lay-in fixture shall be affixed to grid system as specified on Section 26 50 00 and per ASTM E-580.02.

2. Surface mounted individual or continuous rows of fixtures shall be attached to a support suitable for the seismic zone specified. Fixture support devices for attaching to suspended ceilings shall be a locking type scissor clamp or a full loop band which will securely attach to the ceiling support or unistrut channel used to bolt fixture and supported from overhead structure. Fixtures attached to underside of a structural slab shall be properly anchored to the slab at each corner of the fixtures. Each wall mounted light fixture shall be secured in a manner to hold the unit in place during a seismic disturbance.

3. Loop and hook or swivel hanger assemblies for pendant fixtures shall be fitted with a restraining device to hold the stem in the support position during earthquake motions. Pendant supported fixtures shall also be provided with a flexible hanger device at the attachment to the fixture channel to preclude breaking of the support. The motion of swivels or hinged joints shall not cause sharp bend in conductors or damage to insulation.

4. Suspension systems for light fixtures, as installed, that are free to swing a minimum of 45 degrees from the vertical in all directions without coming in contact with other parts of the building, and will withstand, without failure, a force of not less than 4 times the weight it is intended to support will be acceptable.

5. Suspended light fixture shall be supported individually by chains, one chain per corner, supported from overhead structure.

END OF SECTION 26 05 29

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PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Electrical conduit and tubing systems for power and low voltage applications.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 26 05 35 - Conduit And Other Requirements For Communications, Security and Safety Cabling.

B. Section 26 05 37 - Sleeves and Penetrations

1.3 GENERAL:

A. All wiring shall be in rigid galvanized metal conduit, 'RMC', except as otherwise noted.

B. Rigid steel, or intermediate metal conduit shall be used in all areas of the project except as otherwise noted. All ‘IMC’, underground feeder and service conduit shall be encased in 3-inches of concrete all around.

C. Schedule 40 PVC conduit may be used as underground raceways for underground feeders and branch circuits outside building perimeter only. All PVC conduit stub-up elbows shall be rigid steel conduit. Feeders run in PVC conduit shall be encased in 3” of concrete all around.

D. EMT may be used in the following applications for power and telecommunication circuits:

1. Concealed in dry construction walls and above ceiling in dry locations
2. Exposed in dry locations above 8’-0” above floor

E. Flexible metallic conduit shall not be used as a wiring method, other than when specifically noted to be used, without prior permission of Owner.

F. MC cable is <u>not</u> allowed in this project.

1.4 TELEPHONE AND DATA NETWORK WIRING SYSTEM RACEWAY:

A. Refer to Section 26 05 35.

1.5 SLEEVES AND PENETRATIONS:

A. See Section 26 05 37 for required sleeves and method of achieving raceway penetrations.

1.6 APPLICABLE SPECIFICATIONS AND STANDARDS:

A. The materials specified here shall meet the following specifications and standards in their current edition.

1. UL Standards:

a. UL 1 Flexible Metal Conduits
b. UL 6 Rigid Metal Conduit

c. UL 1242 Intermediate Metal Conduit

2. NEMA Standards:

a. TC 2 Electric Polyvinyl Chloride Tubing and Conduit

3. ANSI Standards:

a. ANSI C80.1 Rigid Steel Conduit, Zinc Coated

PART 2 - PRODUCTS

2.1 RACEWAYS:

A. General: Minimum size conduit shall be ½ inch, except as otherwise noted for telecommunications.

B. Rigid Metal Conduit:

1. Rigid metal conduit shall be schedule 40, of the best quality steel.

2. The interior and exterior surfaces of the conduit shall be protected with a metallic zinc coating. Rigid steel conduit shall be galvanized by the Hot-Dip process in accordance with ASTM A 123.

3. Fittings for 'RMC' shall be threaded type, UL listed.

C. Electric Metallic Tubing:

1. Electrical metallic tubing shall be metal conduit of the thin-wall type in straight lengths, elbows or bends for use as raceways for wire or cables in an electrical system.

2. Electrical metallic tubing shall utilize zinc coated steel, or malleable iron, compression, or set screw, threadless fittings. No Zinc alloy fitting allowed.

3. Provide EMT connections with insulated throats.

D. Flexible Metallic Conduit:

1. Flexible metallic conduit shall conform to UL standard 'Flexible Steel Conduit'. All steel used in the fabrication of the conduit shall be zinc coated.

2. Liquid-tight flexible steel conduit shall be provided with a protective jacket of polyvinyl chloride extruded over a flexible interlocked galvanized steel core to protect wiring against moisture, oil, chemicals and corrosive fumes.

3. Flexible conduit connectors shall be UL listed T & B nylon-insulated "Tite-Bite", or equivalent from "Blackhawk.'

4. Use flexible metallic conduit for final connection to mechanical equipment, transformers, and light fixtures. Use liquid-tight flexible metallic conduit for final connections to outdoor equipment and in the kitchen. Provide liquid-tight connectors.

E. Rigid Non-Metallic Conduit:

1. Schedule 40 (EPC-40), heavy wall polyvinyl chloride plastic conduit and fittings, UL listed, suitable for 90 degree C. conductors.

2. Stub-up elbows shall be rigid steel conduit.

F. Intermediate Metal Conduit:

1. Intermediate metal conduit 'IMC' shall be zinc coated steel, UL listed and labeled.

2. Fittings shall be the same type as for 'RMC.'

G. Wireways and Troughs:

1. Wireways or troughs shall be of the size noted on the drawings or as required by the NEC of code gauge galvanized steel. Sizes 6 inch x 6 inch and smaller wireways and all troughs shall be of the hinged cover type except as otherwise noted on the drawings. Larger sized wireways shall be of the flangeless screw cover lay-in type. All shall be without knockout, and shall be provided with fittings, supports, and appurtenances as required.

PART 3 - EXECUTION:

3.1 INSTALLATION OF CONDUIT AND TUBING:

A. See Section 26 05 29 for additional support requirements.

B. Metallic raceways shall not be stored exposed to the weather.

C. Conduits shall be concealed within the walls, ceilings, and floors, where possible, and shall be kept at least 6 inches from parallel runs of flues, steam pipes, or hot water pipes. Exposed runs of conduit or tubing, and conduit or tubing run above suspended ceilings, shall have supports spaced not more than 8 feet apart and shall be installed with runs parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings with right-angle turns consisting of cast metal fittings or symmetrical bends. All raceways shall be run in a neat and orderly fashion. Conduits or tubing run in diagonal or disorganized way shall be removed from the premises if so instructed by the A/E. Bends and offsets shall be avoided where possible, but where necessary shall be made with an approved hickey or conduit bending machine. Conduit or tubing which has been crushed or deformed in any way shall not be installed.

D. Conduit and tubing shall be supported on approved types of galvanized wall brackets, ceiling trapezes, strap hangers, or pipe straps, secured by means of toggle bolts on hollow masonry units, expansion bolts in concrete or brick, machine screws on metal surfaces, and wood screws on wood construction. Nails shall not be used as the means of fastening boxes on conduits. Wooden plugs inserted in masonry or concrete shall not be used as a base to secure conduit supports.

E. Conduits shall be installed in such manner as to insure against trouble from the collection of trapped condensation, and all runs of conduit shall be arranged so as to be devoid of traps where feasible. The contractor shall exercise the necessary precautions to prevent the lodgment of dirt, plaster, or trash in conduit, tubing, fittings, and boxes during the course of installation by the use of T & B pushpennies, appleton pennies, or equal

closures. A run of conduit or tubing which has become clogged shall be entirely freed of these accumulations or shall be replaced.

F. Conduit shall be securely fastened to all sheet metal enclosures with double galvanized locknuts and insulated bushings, care being observed to see that full number of threads project through to permit the bushing to be drawn tight against the end of conduit, after which the locknuts shall be made up sufficiently tight to insure positive ground continuity between conduit and box.

G. Double locknuts shall be used on all feeder and motor circuit conduits and where insulated bushings are used. Insulated bushings of molded bakelite shall be used on all conduit entrances, one inch over in size, into junction boxes, panel boxes and motors starters having sheet metal enclosures. Galvanized steel insulated throat fittings shall be used for EMT work.

H. 'RMC' or 'IMC' directly installed underground shall be coated with two coats of bitumastic paint. Conduit installed underground or in concrete on ground shall be made watertight by wrapping the joints with 'Teflon' tape.

I. Standard size conduit bodies, type LB, LR, LL, etc., shall not be used on 1 1/4" or larger conduits containing power conductors. Where required, pull boxes shall be used. Where pull boxes can not physically be installed, the use of oversized conduit bodies may be acceptable, provided the distance between each raceway entry shall not be less than six times the trade diameter of the largest raceway.

3.2 CONDUIT WATER SEALING:

A. Conduit penetrations from the exterior of the building shall be accomplished utilizing Link-Seal wall penetration system, or approved equivalent system.

B. For applications where the wall is yet to be poured or built, utilize Link-Seal plastic sleeve and sealing fitting appropriate for the size of the conduit penetrating wall. Sleeve shall be Link-Seal CS model series plastic sleeve with waterstop/reinforcing ribs of length suitable for the thickness of the wall. Sleeve diameter shall be recommended by seal system manufacturer. Sealing fittings shall be modular Link-Seal module 'C' suitable for use in water, direct ground burial and atmosphere conditions comprising of EPDM seal elements, reinforced nylon polymer pressure plate, and 2-part zinc dichromate corrosion inhibiting coated steel bolts and nuts.

C. For applications where the wall has been already poured, use the same Link-Seal method except core-drill wall to create a smooth hole of dimensions suitable for the conduit being installed. Then provide Link-Seal water sealing fitting, Model 'C' series as previously specified.

D. Below Floor Slab Perimeter Wall Penetrations:

1. Seal interior of all incoming conduits from exterior building with sealing compounds and plugs, as required to withstand 15 PSI minimum hydrostatic pressure. If the conduit penetrates from outside to a lower interior location, seal the interior of each such conduit utilizing O.Z.-GEDNEY type CSB or CSM type sealing fittings, or use sealing compound like polywater FST™ duct sealing, or equivalent as approved by the Architect/Engineer.

3.3 EXPANSION FITTINGS:

A. Conduit crossing expansion joints in concrete slabs shall be provided with suitable expansion fittings, or other suitable means shall be provided to compensate for the building expansion and contraction.

3.4 PULL WIRE:

A. Nylon pull wire not less than 3/32 inches in diameter shall be installed in all empty conduit longer than 10 feet. Pull wire shall be secured at each end and tagged for identification of the use of the conduit.

3.5 NOISE SEAL

A. Seal with appropriate caulking material any conduit penetration through non-rated wall to attenuate sound transmission.

B. Provide sealing material to limit air movement and sound via electrical conduits penetrating mechanical or electrical rooms. Also, provide seals in conduit between two outlet boxes in different rooms when conduit length is less than 24". Sealing material shall be Permagum by Virginia Chemical. Install 1" of Permagum in space between conduit and conductors.

3.6 EXPOSED RACEWAYS:

A. Run exposed raceway as high as possible along structural members to minimize visibility. Paint all exposed raceway to match color of surrounding surfaces.

3.7 CONDUIT CAPS

A. Provide threaded caps on any conduit sleeve, or empty conduit. In addition, provide watertight plugs or fittings if conduit or sleeve is exposed to weather or water runoff.

3.8 CONDUIT ON ROOF

A. Conduit on roof is not allowed as a wiring method unless otherwise specifically noted on the drawings, and for the minimum required to accomplish connection to the HVAC roof mounted equipment. Do not run conduit on roof that will be visible from grade level. Do not run conduit on roof that will present a tripping hazard. Do not run conduit on roof that could have been run within building, or overhead on roof structures. Conduit that must be run on roof will be IMC or RMC supported on UV resistant, waterproof, rubber support blocks, suitable for membrane roof, with galvanized steel channel on top. Minimum installation height from bottom of conduit to roof surface shall be 5-inches. Branch circuit conductors within conduit installed on roof shall be increased in size from what is shown on drawings to comply with NEC Table 310.15(B)(6)(c) derating requirements. Do not use liquid tight flexible metallic conduit except for final connection to equipment.

3.9 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

END OF SECTION 26 05 31

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SECTION 26 05 35 - CONDUIT SYSTEMS AND OTHER REQUIREMENTS FOR COMMUNICATIONS, SECURITY AND SAFETY CABLING

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. This section describes requirements for the conduit system and related items required under Division 26 – Electrical for the installation of cabling system specified under Division 28.

B. Division 26 contractor shall provide a complete raceway system for intercom, voice, data, public address, sound, audio equipment for surveillance TV (CCTV), access control, fire alarm, area of rescue communication system and intrusion detection and alarm system**,** as required for the installation of these systems, including backboxes for flush-in wiring speakers and speaker grid mounts.

1.2 APPLICABLE REQUIREMENTS:

A. The requirements of the following specifications shall also apply to the work:

1. 26 01 00 - Basic Electrical Requirements
2. 26 05 26 - Grounding and Bonding for Electrical Systems
3. 26 05 29 - Hangers and Supports for Electrical Systems
4. 26 05 31 - Conduit
5. 26 05 41 - Boxes & Enclosures
6. 28 31 00 - Fire and Smoke Detection System

1.3 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 26 05 36 - Low Voltage Wiring Cable Trays

PART 2 - PRODUCTS

2.1 FIRE STOPPING PENETRATIONS:

A. All penetrations through walls, floors and ceilings will be sleeved and fire-stopped to re-establish the integrity of fire-rated architectural structures and assemblies to appropriate building codes and EIA/TIA 569-A. If the partition is not rated seal off the penetration with duct seal for a depth of not less than 2 inches.

B. Existing fire-stopping material, which is disturbed or damaged by work, shall be replaced and restored to code.

C. Conduit sleeves shall be cut flush with the wall/floor on each side and provided with bushing.

D. No PVC sleeves shall be used for penetrations.

E. All penetrations for fire rated walls shall be fire-stopped and sealed per an approved UL Design.

F. The College and the building official shall receive a copy of the approved UL design used for fire-stopping and sealing of firewall penetrations.

2.2 TELEPHONE ENTRANCE CONDUIT REQUIREMENTS:

A. All conduit bends shall have a minimum radius of ten times the inside diameter of the conduit. LBs are not permitted.

B. A nylon pull line, rated 200 pounds, shall be installed in each of the entrance conduit.

C. Cap the conduit ends to prevent debris, water and gases from entering the conduit and building before cable installation. Use a rubber cap with stainless steel clamps. The responsibility to seal entrance conduits to protect against water damage is left entirely with the electrical contractor. Seal all conduits, both used and spare, water tight to withstand 15 psi of hydrostatic pressure.

D. All fire rated structures, walls, floors, ceilings, that are penetrated during conduit placement must be fire stopped to re-establish the integrity of fire-rated architectural structures and assemblies to appropriate building codes.

2.3 CONDUITS:

A. Provide complete conduit system and required boxes for the installation of the fire alarm system specified under Section 28 31 00. Minimum conduit size shall be ½ inch.

B. Provide raceway system as required, including outlet boxes and special boxes, as required for the installation of the specified sound systems. Intrusion detection and alarm, TV surveillance (CCTV) and access control systems. Minimum conduit size shall be ½ inch.

2.4 OUTLET BOXES:

A. Usage: Outlet boxes shall be installed at the termination of the conduits which connect the outlet locations to the cable tray.

B. Material: 4" x 4" x ½" steel, square cornered, welded construction in dry wall with one-gang “mud” ring. Surface boxes shall be double gang x 3" deep, cast metal type. All boxes for telecommunications cabling shall have one-gang opening unless noted otherwise on drawings. Each outlet box shall extend a dedicated conduit from the box to cable tray or to telecom room (whichever is closer). A nylon pull cord shall be included in each empty conduit. Provide gray plastic, blank, temporary cover plate on each telecommunications outlet box.

C. Outlet boxes for fire alarm, intrusion detection, CCTV and access control systems shall be as directed by system installer.

D. Additional Requirements:

1. Refer to Section 26 05 41 for outlet box installation requirements.

2. Flexible conduit for data/voice cabling is only permitted in drywall cavities and block wall and from power poles.

3. Conduit for low voltage cabling shall be run overhead and not under/in slab whenever possible.

4. All conduits shall have no continuous sections longer than 100 feet without a j-box. All conduits shall not have two 90 degrees or a reverse bend (U shape) between pull points without a pull box.

5. Pull and splice boxes shall be labeled on the exposed exterior per TIA/EIA-606. Labeling shall be easily visible.

2.5 PROVISIONS FOR OUTDOOR CAMERAS:

A. Provide weatherproof 2-gang outlet box with 1-gang gasketed coverplate for signal wiring each camera installed on the exterior of the building. Provide 3/4” conduit with pull cord from each box to building cable tray.

PART 3 - EXECUTION

3.1 GENERAL:

A. Pull lines shall be provided in each raceway for use in installing telephone and data cables and for TV surveillance (CCTV) and access control systems. The pull lines shall be nylon rope of no less than 3/32 inch diameter and securely anchored at each end. Each pull line shall be cumbered with same distinctive number at both ends of the line for ease in identification. Provide not less than 12 inches of slack.

B. Refer to referenced sections for additional requirements.

C. The conduit systems specified here shall be installed in such a manner that no length of run shall exceed 100 feet and shall not contain more than two 90-degree bends or the equivalent.

D. All work above the ceiling partitions shall be coordinated with the other trades. All conduits passing through firewalls and smoke partitions shall be firestopped after installation of cabling is complete. All sleeves passing between floors shall be firestopped after installation of cabling is complete.

E. All home run or distribution system conduits, upon entering the telecom room, shall either stub up 4" onto the surface of the plywood or stub down 4" below the top edge of the plywood.

F. Conduits terminating in telecom room(s) shall be neatly aligned and shall be installed with connectors and plastic bushings at the plywood backboard. Outlet conduits that enter the telecommunications room shall stub down 4" onto the plywood if installed from above and stub up 4" onto the plywood if installed from below.

G. For other requirements refer to Section 26 05 31. Also refer to Division 28 specifications for additional requirements.

END OF SECTION 26 05 35

SECTION 26 05 36 - LOW VOLTAGE WIRING CABLE TRAYS

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. 26 05 26 - Grounding and Bonding for Electrical Systems
2. 26 05 29 - Hangers and Supports for Electrical Systems
3. 26 05 31 - Conduit
4. 26 05 35 - Conduit Systems and Other Requirements for Communications, Security and Safety Cabling

1.2 SCOPE

A. Provide telecommunications wiring cable tray systems as shown on drawings complete with all necessary fittings, and accessories required for a successful installation in coordination with other building systems. Cable tray system construction, design and installation shall conform to Article 318 of the National Electrical Code (and NEMA Standard VE 1).

1.3 SUMMARY

A. This Section includes steel cable trays and accessories.

1.4 SUBMITTALS

A. Product Data: Include data indicating dimensions and finishes for each type of cable tray indicated.

B. Shop Drawings: For each type of cable tray, show fabrication and installation details of cable tray, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.

C. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer, licensed in the state where Project is located, who is responsible for their preparation.

D. Design Calculations: Calculate requirements for selecting seismic restraints. Refer to Section 26 05 29.

E. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.

F. Coordination Drawings: Floor plans and sections, drawn to scale. Include sealed cable tray layout and relationships between components and adjacent structural, electrical and mechanical elements. Show the following:

1. Vertical and horizontal offsets and transitions
2. Clearances for access above and to side of cable trays
3. Vertical elevation of cable trays above the floor or bottom of ceiling structure
4. Field quality-control reports

G. Operation and Maintenance Data: For cable trays to include in emergency, operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain cable tray components through one source from a single manufacturer.

B. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by as testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 DELIVERY, STORAGE AND HANDLING

A. Aluminum cable tray may be stored outside without cover, but shall be loosely stacked, elevated off the ground, and ventilated to prevent staining during storage.

B. Steel cable tray shall be stored in a well-ventilated, dry location. Unpack and dry wet materials before storage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cablofil
2. Chalfant Manufacturing Company
3. Cooper B-Line, Inc.
4. Cope, T.J., Inc.; a subsidiary of Allied Tube & Conduit
5. GS Metals Corp.; GLOBETRAY and Flextray Products
6. MONO-SYSTEMS, INC.
7. MPHusky
8. PW Industries

2.2 MATERIALS AND FINISHES

A. Cable trays, fittings, and accessories: Steel, complying with NEMA VE 1.

2.3 CABLE TRAY FOR AREAS OTHER THAN TELECOMMUNICATION ROOMS:

A. The cable tray shall be a welded wire mesh cable management system. The open mesh permits easy tray access and provides continuous ventilation of cables installed in the tray, preventing heat buildup and accumulation of dust, bacteria and other contaminants. The system shall be installed above accessible ceilings. Cabletray run exposed through public areas shall be ladder type, with solid bottom. Cabletray shall be supported on unistrut channel. A continuous ground conductor fixing system shall be accomplished by the use of approved splices and bonding jumpers.

B. Cable tray shall be listed as an equipment grounding conductor.

C. Composition & Materials: The cable tray shall be produced from high mechanical strength steel wire which is first welded into a net, then formed into channels to carry the cables. Splice plates in made of electro galvanized steel shall effectively connect trays end to end.

D. Sizes: Cable tray shall be 18” wide by 4" deep unless otherwise noted.

E. Wire Diameter - A minimum of 0.197" on all mesh sections.

F. Finishes: Finish shall be EZ Electroplated Zinc Galvanized - 0.7 to 0.8 mil (0.018 - 0.020 mm).

2.4 CABLE TRAY ACCESSORIES

A. Fittings: Tees, crosses, risers, elbows and other fittings as indicated, of same materials and finishes as cable tray.

B. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer. Center hanger supports are not allowed.

2.5 WARNING SIGNS

A. Lettering: 1-1/2 inch (40 mm) high, black letters on yellow background with legend “WARNING! NOT TO BE USED AS WALKWAY, LADDER, OR SUPPORT FOR LADDERS OR PERSONNEL”.

B. Materials and fastening are specified in Section 26 05 53 – “Identification for Electrical Systems”.

PART 3 - EXECUTION

3.1 CABLE TRAY INSTALLATION

A. Comply with recommendations in NEMA VE 2. Install as a complete system including all necessary fasteners, hold-down clips, splice-plate support systems, barrier strips, hinged horizontal and vertical splice plates, elbows, reducers, tees and crosses.

B. Remove burrs and sharp edges from cable trays.

C. Fasten cable tray supports to building structure and install side and longitudinal bracing.

D. Configuration: Shall be as shown on drawings and as required to fit in the ceiling cavity. Whenever obstruction is encountered in cable tray path, shift cable tray location to avoid conflict with obstruction. Bidder shall assume that there will be two (2) vertical offsets for each 100-foot run or fraction thereof, of cable tray.

E. Design each fastener and support to carry load indicated by seismic requirements and to comply with movement restraint according to Section 26 05 29.

F. Place supports so that spans do not exceed 5’-0”.

G. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application. Cable tray shall be supported to stand up to 100 pounds per linear foot, or higher load.

H. Support bus assembly to prevent twisting from eccentric loading.

I. Locate and install supports according to NEMA FG but in no case further than 5'-0" apart.

J. Make connections to equipment with flanged fittings fastened to cable tray and to equipment. Support cable tray independent of fittings. Do not carry weight of cable tray on equipment enclosure.

K. Install expansion connectors where cable tray crosses building expansion joint and in cable tray runs that exceed dimensions recommended in NEMA FG 1. Space connectors and set gaps according to applicable standard.

L. Make changes in direction and elevation using standard fittings.

M. Make cable tray connections using standard fittings.

N. Seal penetrations through fire and smoke barriers according to Section 07 84 13 – "Penetration Firestopping."

O. Sleeves for future cables: Install capped sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.

P. Workspace: Install cable trays with enough space to permit access for installing cables.

Q. After installation of cable trays is completed, install warning signs in visible locations on or near cable trays.

3.2 CABLE INSTALLATION

A. The electrical contractor shall coordinate the installation of the cable tray with electrical fixtures and plumbing, fire protection and HVAC contractors to minimize conflicts and to accomplish the most accessible and straight route. Include exact routing, dimensions, and configuration of cable tray with mechanical/electrical coordination drawings. Figure that for each 100 feet of straight cabletray run, the installation will require two vertical offsets, over and above what is shown on the drawings.

B. Provide lateral bracing at each end of each cable tray section and every 30 feet of length, as specified in Section 26 05 29.

C. Conduit connections shall be supported independently from cable tray but shall be terminated as close as possible to cable tray without interfering with cable tray fill capacity.

D. Cable tray system shall generally be run above and adjacent to lighting fixtures, as close to ceiling as possible, to minimize conflict with ductwork and piping. Avoid having light fixtures over trays to assure easy access to tray.

E. Install cables only when cable tray installation has been completed and inspected.

F. Fasten cables on horizontal runs with cable clamps or cable ties as recommended by NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.

G. On vertical runs, fasten cables to tray every 18 inches (457 mm). Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

H. In existing construction, remove inactive or dead cables from cable tray.

I. Install covers after installation of cable is completed.

3.3 CONNECTIONS

A. Bond cable trays according to manufacturer's written instructions, utilizing #6 bare grounding copper cable and listed connectors to accomplish a continuous grounding path.

B. Bond cable tray to "TMGB" grounding bus in telecommunication room.

3.4 FIELD QUALITY CONTROL

A. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements. Perform the following field quality-control survey:

1. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable tray, vibration and thermal expansion and contraction conditions, which may cause or have caused damage.

2. Verify that the number, size and voltage of cables in cable tray do not exceed that permitted by NFPA 70.

3. Verify that there is no intrusion of such items as pipe, hangers, or other equipment that could damage cables.

4. Remove deposits of dust, industrial process materials, trash of any description and any blockage of tray ventilation.

5. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and re-torque in suspect areas.

6. Check for missing or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.

7. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all take off raceways are bonded to cable tray.

8. Report results in writing.

3.5 PROTECTION

A. Protect installed cable trays.

B. Install temporary protection for cables in open trays to protect exposed cables from falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials until the risk of damage is over.

END OF SECTION 26 05 36

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SECTION 26 05 37 - SLEEVES AND PENETRATIONS

PART 1 - GENERAL

1.1 SCOPE:

A. Provide sleeves, seals and openings for raceway penetrating exterior walls, interior masonry walls and rated partitions, floors, and roofs as specified here, and as applicable to the project.

B. All sleeves, seals and openings required shall be located and provided by this Contractor for his portion of the work.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

A. FIRE AND SMOKE BARRIERS PENETRATION SEALS: Provide seals for openings in floors, walls and other elements of construction in accordance with Section 07 84 13 – “Penetration Firestopping” and Section 26 05 31 – “Conduit.”

PART 2 - PRODUCTS

2.1 CONDUIT SLEEVES, SEALS AND ESCUTCHEONS:

A. Provide sleeves for each conduit passing through walls, partitions, floors and roofs.

B. Sleeve Material:

Type Designation

1. 18 gauge, adjustable or fixed length, galvanized steel.

2. Standard weight galvanized steel pipe or conduit.

3. Standard weight galvanized steel pipe or conduit with a continuous welded stop of 1/4" steel plate extending outside of sleeve a minimum all around.

4. Cast iron pipe sleeve with center flange.

5. Standard weight galvanized steel pipe with flashing clamp device welded to pipe sleeve or watertight sleeves, similar to Josam 1870-A2, 1870, 1940-C with oakum and lead caulking compound.

C. Sleeve Sizes:

1. Sleeves for conduit or cables shall be adequate size to accommodate a minimum of 1/2" clearance between inside of sleeve and outside of pipe.

D. Sleeve Lengths:

	Location	Sleeve Length
1.	Floors	Equal to depth of floor construction including finish. In waterproof floor construction sleeves to extend minimum of 2" above finished floor level.
2.	Walls and Partitions	Equal to thickness of construction and terminated with surfaces.

E. Sleeve Caulking and Packing:

Type
Designation / Caulking and Packing Requirements

1. Type A - Space between metallic conduit and sleeve shall be provided with waterproofing seal method as specified under Section 26 05 31.

2. Type B - Space between metallic conduit and sleeve shall be caulked with a fire resistant foam sealant, per Section 07 84 13.

3. Type C - Space between conduit covering and sleeve shall be packed with mineral wool and sealed tight with caulking.

4. Type D - No sleeve required for metallic conduit penetration. Space between conduit and wall shall be sealed tight with caulking.

F. Sleeve Application:

Sleeve Type	Location	Sleeve Caulking & Packing Type Designation
1	Interior fire rated walls, partitions and floors.	B
	Interior non-rated fire rated stud walls and partitions	D
	Interior non-rated masonry walls and partitions	C
2	Membrane, waterproof floor and wall construction	B
		Note: Another trade will install membrane up around sleeve and inside sleeve.
3 or 4	Exterior Walls	A
5	No membrane, waterproof roof and wall construction where flashing is required.	A or B

G. Escutcheons:

1. Provide escutcheons on all exposed conduit passing through walls, floors, partitions and ceilings.

2. Escutcheons shall be held in place by internal spring tension or set screws.

H. Application:

	Location	Escutcheon Material
1.	Finished spaces	Anodized aluminum **chrome-plated brass**

2.	Unfinished spaces,	Plain brass, cast iron or aluminum **excluding mechanical equipment rooms**

2.2 PENETRATIONS THROUGH ROOF:

A. Penetrations through roof shall be accomplished by roof contractor at the expense of Division 26 electrical contractor.

B. Pipe curbs for raceway and piping passing through roof shall consist of a roof curb, curb covers, and resilient caps with stainless steel clamp sized for passing pipe. Curb covers shall be not less than 12 inches square and where multiple covers are required, galvanized steel troughs shall be provided between covers to provide a watertight assembly. Covers shall be fabricated of ABS plastic with prepunched mounting holes and a laminated acrylic coating. Sealing caps shall be EPDM compression molded rubber, with openings sized for passing pipe or piping and with stainless steel clamps.

C. When feasible, penetrations through roof may be combined in a single pipe curb with piping provided under other trades.

D. Required penetrations through roof for connections to roof top equipment and exhaust fans, shall be through the roof curb provided with the equipment whenever feasible.

PART 3 - EXECUTION:

3.1 PLACEMENT OF SLEEVES:

A. Sleeves shall be furnished and placed and openings located as construction proceeds and in ample time to avoid delay to the work. After construction of wall or floor has been accomplished remove the sleeve and proceed to install raceway or pipe, except that sleeves through floors with membrane waterproofing, fire rated gypsum or plaster drywalls and smoke partitions, shall remain in place properly secured to the slabs or wall.

B. Where sleeves or grouped raceway and pipe are to be installed in openings concurrent with or subsequent to construction, such items shall be securely fastened in place and the opening filled and patched with material approved for the particular construction.

C. Sleeves and openings shall be protected during all phases of construction. Care shall be taken to prevent concrete, plaster or other construction material from closing.

D. Submit to the Architect/Engineer for approval plan of proposed sleeve locations and sites prior to performing any sleeve works.

END OF SECTION 26 05 37

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PART 1 - GENERAL

1.1 WORK INCLUDED:

A. Work under this Section includes but is not necessarily limited to the following:

1. Outlet Boxes
2. Cabinets and Enclosures
3. Access Doors

1.2 APPLICABLE WORK SPECIFIED ELSEWHERE:

A. The outlet boxes required for installation of the following systems shall be provided as part of Section 26 05 41:

1. Section 26 05 35 - Conduit system and other requirements for communications, security and safety cabling.

2. Voice and data wiring systems provided by Owner.

3. Access control system being provided by Owner.

4. Audiovisual systems.

5. Section 28 31 00 - Fire Alarm and Smoke Detection System.

1.3 APPLICABLE SPECIFICATIONS AND STANDARDS:

A. Equipment specified in this Section shall meet the following specifications and standards.

1. UL Standards

   a. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations
   b. UL 514A - Metallic Outlet Boxes

2. NEMA Standards

   a. OS1 – Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports

1.4 QUALITY ASSURANCE:

A. The contractor, through the manufacturer of the equipment specified here, shall review the use, details, and methods of installation of this product as indicated and shall disclose to the Architect any and all deviations from his recommended use and method of installation and shall also disclose to the Architect his recommendations for the use and method of installation of his product to achieve the intended purpose and result. Such disclosure shall be made within the time stipulated for submission of shop drawings.

1.5 SUBMITTALS:

A. Submit manufacturer's catalog data on all products specified here.

PART 2 - PRODUCTS

2.1 OUTLET BOXES, PULL BOXES, CABINETS AND ENCLOSURES:

A. Boxes:

1. Unless otherwise specifically noted, all boxes shall be of the metallic type.

2. Boxes shall have sufficient volume to accommodate the number of conductors entering the box in accordance with the requirements of NFPA 70, Article 370. Outer boxes that are exposed to the weather or that are in normally wet locations shall be of the cast-metal type having threaded hubs. Boxes shall be of suitable construction for installation in the environment of their location. All boxes shall be metallic boxes.

3. Zinc-coated or cadmium-plated sheet steel boxes, or a class to satisfy the conditions of each outlet, shall be used in concealed work or in exposed work above eight feet from floor.

4. Fixture outlet boxes on ceiling shall be not less than 4 inch octagonal. Fixture outlet boxes in concrete ceiling shall be of the 4 inch octagonal concrete type, set flush with the finished surface. Fixture outlet boxes on plastered ceilings shall be fitted with open covers set to come flush with the finished surface.

5. Switch and receptacle outlet boxes in dry walls, plastered walls and pour-in concrete walls shall be not less than 4 inches square cut with appropriate extension to set flush with the finished surface. Minimum depth of junction or outlet box shall be 2 1/8”. One-piece gang or gangable boxes not less than 2 1/8 inches deep shall be utilized where the use of 4-inch square boxes is not feasible. Telecommunications outlet boxes shall be as specified in Section 26 05 35.

6. Unless otherwise noted on the drawings, outlet, junction or pull boxes not larger than 5 inches square and within eight feet from floor level in exposed work shall be of cast steel or alloy with threaded hubs and appropriate covers.

7. Outlet boxes in unplastered masonry walls shall be tile type.

8. Outlet boxes for use with conduit and tubing systems shall be not less than 1 ½ inches deep unless otherwise noted.

9. A device plate or cover shall be provided for each outlet to suit the outlet.

10. Boxes with concentric, eccentric, or oversized knockouts shall be provided with bonding bushings and jumpers. The jumper shall be sized per NEC Table 250-122 and lugged to the box.

B. Pull Boxes:

1. Pull boxes shall be constructed of code-gauge galvanized sheet metal. Boxes shall be of not less than the minimum size required by the National Electrical Code and shall be furnished with screw fastened covers. When several feeders pass through a common pull box they shall be tagged to indicate clearly their electrical characteristics, circuit numbers and panel designations. Pull boxes coverplates larger than four square feet shall be provided with two handles.

2. Pull boxes shall be furnished and installed where necessary, as approved by the A/E, in the raceway system to facilitate conductor installation. Except as otherwise noted for telephone and data raceways, conduit runs longer than 200 feet, or with more than four 90 degree angle bends, shall have a pull box installed at a convenient intermediate location. Normally, when feeder routing is shown on drawings, pull boxes are not indicated. It is the responsibility of the electrical contractor to provide pull boxes as necessary to meet the stated requirements.

C. Cabinets:

1. Cabinet boxes shall be constructed of zinc-coated sheet steel and shall conform with the requirements of Underwriters' Laboratories "Standards for Cabinets and Cutout Boxes". Unless otherwise noted, cabinet trims shall have a corrosion inhibiting primer and a lacquer finish. Cabinets shall be of suitable construction for installation in the environment of their locations.

2.2 ACCESS DOORS IN FINISHED CONSTRUCTION:

A. Study architectural and electrical construction documents for areas with non-accessible finishes.

B. Where boxes and devices are to be concealed in walls or above nonremovable ceilings, each Contractor shall provide the required access panels at no extra cost to the Owner.

C. Submit drawings to the Architect/Engineer showing location of proposed access doors prior to installation of any wiring. Architect/Engineer reserves the right to modify location of access doors proposed by the electrical contractor. Access doors are not permitted in ceilings or walls of public areas like lobbies, theatrical or performance spaces.

D. Size of panels shall be larger than the devices for accessibility and shall not be less than 16"x 16" for all panels. Where the opening must allow adequate room for a person to pass through, a 24"x 24" panel shall be provided.

E. Manufacturers: J.L. Industries (TM and FD Series), Karp Associates, Milcor or approved equal.

F. Study architectural and electrical construction documents for areas with non-accessible finishes.

G. Where boxes and devices are to be concealed in walls or above non-removable ceilings, each Contractor shall provide the required access panels at no extra cost to the Owner.

H. Submit drawings to the Architect/Engineer showing location of proposed access doors prior to installation of any wiring. Architect/Engineer reserves the right to modify location of access doors proposed by the electrical contractor.

I. Size of panels shall be larger than the devices for accessibility and shall not be less than 16"x 16" for all panels. Where the opening must allow adequate room for a person to pass through, a 24"x 24" panel shall be provided.

J. Construction of panels shall comply with the following:

1. Constructed of prime coated steel and installed in a manner that does not violate the fire rating of any ceiling or wall.
2. Have expanded mesh plastering lath on all four sides with appropriate method for securing to masonry, stud wall or ceiling suspension system.
3. Incorporate any modifications required to receive the wall or ceiling finish.
4. Have flush screwdriver-operated cam lock or universal turn ring and key lock.

PART 3 - EXECUTION:

3.1 INSTALLATION OF OUTLET BOXES:

A. Location of outlets shown on drawings, other than those dimensioned, are only approximate, the Owner shall have the right to make slight changes in the position of outlets if the Contractor is notified before roughing-in is done. The Contractor shall study the general building plans in relation to the spaces surrounding each outlet in order that his work may fit the other work required by these specifications. When necessary, the Contractor shall relocate outlets of junction boxes so that, when fixtures or other fittings are installed, they will be symmetrically located according to room layout and will not interfere with other work or equipment. Do not install outlets back to back.

B. Minimum length of conduit connecting to adjacent flush in wall outlets in sound rated walls shall be 18".

C. Boxes shall be installed in a rigid and satisfactory manner, either by wood screws on wood, expansion shields on masonry, or machine screws on steel work.

D. Recessed boxes in dry wall type construction shall be supported from both adjacent studs, or by the use of metal stud brackets as manufactured by E-Z Mount Bracket Co., or equivalent.

3.2 INSTALLATION OF ABOVE THE CEILING OUTLET BOXES:

A. Outlet boxes shall be supported independently of conduit in accordance with NEC. Outlet boxes shall be installed at accessible locations. Do not use suspended ceiling grid to support outlet boxes.

3.3 INSTALLATION OF PULL BOXES:

A. Pull boxes shall be installed overhead or on walls at locations free of interference with equipment, ducts, piping and activities being carried out at the premises.

3.4 BOXES AND CABINETS IN FIRE RATED WALLS:

A. Outlet boxes in one and two-hour fire rated walls shall be installed in conformance with approved UL methods. UL listed steel electrical outlets, switches, or junction boxes not exceeding 16 square inches in area and 2 3/16" in depth, in hollow walls or partition assemblies utilizing wood or metal studs or metal framing or channels are permitted,

provided such openings do not exceed an average of 100 square inches per 100 square feet of wall and are staggered not less than 24 inches side-to-side horizontally when openings are provided on both sides of the assembly.

B. When location or dimension of outlet boxes does not meet the requirements listed above, protect each outlet utilizing gypsum board sheathing or fire proofing blankets in accordance with UL approved methods. One product approved to protect outlets is 3M Company moldable Putty Pads, Catalogue Number MPP-1.

C. Provide gypsum board covering all five sides of cabinets mounted in one or two hour fire rated walls to maintain rating of wall.

D. Do not provide outlet boxes or cabinets in 4-hour rated walls.

END OF SECTION 26 05 41

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SECTION 26 05 48 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Specification Section 26 01 00 – Basic Electrical Requirements, Drawings, and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 GENERAL

A. Provide seismic supports and seismic restraints for electrical equipment and electrical materials, as required, to the extent required by the IBC.

1.3 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Spring isolators.
3. Restrained spring isolators.
4. Channel support systems.
5. Restraint cables.
6. Hanger rod stiffeners.
7. Anchorage bushings and washers.

B. Related Sections include the following:

1. Section 26 05 29 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.4 DEFINITIONS

A. The IBC: International Building Code.
B. ICC-ES: ICC-Evaluation Service.
C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.5 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: C
2. Risk Category: II
3. Seismic Design Category: C

1.6 ACTION 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 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. Delegated-Design Submittal: For seismic-restraint details required to comply with IBC, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.

    a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other electrical Sections for equipment mounted outdoors.

2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.

3. Field-fabricated supports.

4. Seismic-Restraint Details:

    a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events.

1.7 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

B. Qualification Data: For professional engineer.

C. Welding certificates.

D. Field quality-control test reports.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. 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. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

E. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SEISMIC-RESTRAINT DEVICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Basis-of-Design Product: Subject to compliance with requirements, provide products by one of the following manufacturers:

    a. Amber/Booth Company, Inc.
    b. California Dynamics Corporation.
    c. Cooper B-Line, Inc.; a division of Cooper Industries.
    d. Hilti Inc.
    e. Loos & Co.; Seismic Earthquake Division.
    f. Mason Industries.
    g. TOLCO Incorporated; a brand of NIBCO INC.
    h. Unistrut; Tyco International, Ltd.

C. 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 four times the maximum seismic forces to which they will be subjected.

D. 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.

E. 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.

F. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod. Do not weld stiffeners to rods.

G. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.

H. 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.

I. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

J. 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.

K. 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.

2.2 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. All hardware shall be galvanized. Hot-dip galvanize 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

3.1 EXAMINATION

A. Examine areas and equipment to receive 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 only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

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 indicated or scheduled on Drawings to receive them and 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.

3.3 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 inch.
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 mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. 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.

D. 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.

3.4 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.

3.5 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, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent 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.

3.6 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 26 05 48

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SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish and install engraved three-layer, laminated phenolic nameplates for all safety switches, panelboards, transformers, switchboards and other electrical equipment supplied for the project for identification of equipment, controlled, served, phase, voltage, etc. Nameplates shall be securely attached to equipment with self-tapping stainless steel screws, and shall identify equipment controlled, attached, etc. Letters shall be approximately 1/4 inch high minimum. Embossed, self-adhesive plastic tape is not acceptable for marking equipment, except as otherwise noted for wiring devices. Nameplate material colors shall be:

1. Black surface with white core for power equipment
2. Bright red surface with white core for all equipment related to fire alarm system.
3. Orange surface with white core for all equipment related to telephone systems.
4. Brown surface with white core for all equipment related to data systems.

B. All empty conduit runs and conduit with conductors for future use shall be identified for use and shall indicate where they terminate. Identification shall be by tags with string or wire attached to conduit or outlet.

C. All outlet boxes, junction boxes and pull boxes shall have their covers and exterior visible surfaces painted with colors to match the surface color scheme outlined above. This includes covers on boxes above lift-out and other type accessible ceilings.

1.2 NAMEPLATE INFORMATION:

A. Nameplate for panelboards shall indicate their designation plus circuit designation of panelboard feeder. For example: "Panel MC - 208/120 volts - Fed from Panel MDP-26, 28, 30 via step-down transformer". In addition, provide nameplate on each panelboard identifying conductor color coding in accordance with NEC 210.5(c)

B. Nameplates for individual circuit breakers shall indicate equipment served, circuit breaker frame and size in amperes of the breaker trip, plus circuit designation of power source.

C. Nameplates for individually mounted safety switches shall indicate designation of equipment served, size in ampere of fuses, type of fuses, plus circuit designation of power source. For example' "Pump P-5 circuit 2MCB-A6".

D. Nameplates for dry type transformers shall indicate equipment served, and circuit designation of primary side power source.

E. Nameplates for troughs or wireways shall indicate given designation, voltage, phases and number of wires plus circuit designation of trough feeder.

F. Equipment likely to be energized from two different sources at the same time shall be provided with warning nameplates clearly stating this condition.

G. Pushbuttons, control and selector switches, and indicating lights in remote control stations shall be identified with engraved laminated plastic name plates affixed to front cover in a suitable location. The nameplate shall carry the identification of the system which is being controlled.

H. Each receptacle, in other than public lobbies and public area of main auditorium, shall be provided with label identifying circuit feeding receptacle. (For Example: "422P-16"). Use embossed type adhesive tape with 3/16", black letters on clear background, under heavy duty transparent "Scotch" adhesive tape for reinforcement.

PART 2 - PRODUCTS

2.1 CONSTRUCTION:

A. Nameplates shall be 1/8 inch thick of phenolic material with all four face edges beveled 45 degrees, except that nameplates for wiring devices may be 1/16 inch thick of same type construction. Lettering shall be machine engraved to expose contrasting inner core color.

B. Lettering for sequence of operation signs, wiring devices and other lengthy explanatory signs, shall be not less than 1/8 inch high.

PART 3 - EXECUTION

3.1 GENERAL:

A. Affix nameplates to plates or equipment utilizing manufacturer's supplied mounting provisions when available, pop rivets or other suitable means approved by the A-E.

END OF SECTION 26 05 53

PART 1 - GENERAL

1.1 SUMMARY

A. Provide computer based fault-current and overcurrent protective device coordination study for each power distribution system. Electrical distribution systems study from normal and alternate power source to be performed by the supplier of the electrical gear package for this project. Studies performed by independent companies not working for gear manufacturers are not acceptable. The study shall cover the following:

1. Fault currents
2. Overcurrent protective device coordination
3. Arc flash values, flash boundaries and arc flash hazard category

B. A professional engineer, licensed by the state of North Carolina, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.

1.2 QUALITY ASSURANCE

A. Services and work specified here shall comply with the following standards:

1. NFPA 70E, IEEE 242, IEEE 399, IEEE 1584.

1.3 COMPONENTS

A. Computer software program for plotting and diagramming time-current characteristic curves and for reporting settings and ratings of all overcurrent protective devices.

B. Provide the following for each device and device assembly:

1. Arcing faults
2. Arc flash values
3. Arc flash boundary
4. Arc flash hazard category
5. Simultaneous faults
6. Explicit negative sequence
7. Mutual coupling in a zero sequence
8. Recommended settings for the time/current trip functions of the devices

1.4 SUBMITTALS

A. Submit study to A/E for verification and validation, as applicable. The project electrical engineer shall review the study and shall identify additional requirements or changes that are required to complete the study to his/her satisfaction.

1.5 CONTRACTOR RESPONSIBILITIES

A. Contractor is responsible for providing all required information necessary to complete the study. This information includes, but is not necessarily limited to the following:

1. Utility company available fault data
2. One line and power riser diagrams
3. Length of cables for each feeder
4. Cable sizes and conduit type for each feeder
5. Rating of power company transformer, impedance and primary fault available
6. Configuration, rating and impedances of pad-mounted transformers, dry-type transformers and generators
7. List of all motors being connected to the system

1.6 GEAR SHOP DRAWING APPROVAL

A. Approval of the contractor's proposed gear is conditional to having completed and submitted the overcurrent protective device coordination study at least two weeks prior to submitting the shop drawings. If the contractor chooses to submit the proposed gear for approval prior to the submittal of the coordination study, it shall be with the stipulation that any change in circuit breaker required to comply with the recommendations of the coordination study shall be accomplished without extra charge to the project, the owner or the A/E.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.1 GENERAL

A. Provide, as part of coordination study, a schedule of proposed settings for each service and feeder adjustable trip overcurrent protection device with the recommended setting. This schedule, once it is approved by the project electrical engineer, will be used by the contractor to set the time/current trip functions of all adjustable devices.

3.2 LABELING

A. Provide label complying with requirements of NFPA-70E at each new panelboard and individual feeder protection devices stating the potential flash boundary and the arc flash hazard category and the type of clothing required to be protected from the potential hazard. Install labels on face of distribution equipment. Self-adhesive computer generated labels are acceptable. Labels exposed to weather shall be weather and sun-light proof for at least 15 years.

B. Every equipment/electrical/mechanical room where work is done under this project:

1. Shall have a personal protective equipment reference chart for arc-flash categories
2. This reference shall be 11" x 17" and posted on wall in room

C. Every electrical panel/motor control, individual circuit breaker center/disconnect switchgear shall have an arc flash label. Each label shall have the following information:

1. Flash Hazard Boundary
2. Cal/cm 2 flash hazard at 18 inches
3. PPE-Category Appropriate
4. Shock Hazard/voltage
5. Glove Class
6. Limited Approach
7. Restricted Approach
8. Prohibited Approach
9. Bus: Panel Name Information

3.3 COMMISSIONING:

A. This contractor, and the manufacturer of the equipment and materials specified in this section, shall provide the labor, materials, equipment, services and support required by the project commissioning agent to accomplish the successful commissioning of the equipment and systems specified here.

END OF SECTION 26 05 74

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SECTION 26 09 25 - OCCUPANCY SENSOR LIGHTING CONTROL SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.

B. Contractor/Supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 26.

C. Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, fixtures, HVAC systems and building management systems.

1.2 EQUIPMENT QUALIFICATION:

A. Products supplied shall be from a single manufacturer that has been continuously involved in the manufacturing of occupancy sensors for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.

B. All components shall be UL listed.

C. Products shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

D. Wall switch products must be capable of withstanding the effects of inrush current. Submittals shall clearly indicated the method used.

E. Occupancy sensor lighting control system shall be fully compatible with the LED drivers of lighting fixtures specified and submitted.

1.3 SYSTEM DESCRIPTION:

A. Provide occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area and lighting is automatically turned back on when a person enters the room. Sensors shall be wall or ceiling mounted as shown on drawings and as appropriate for the application.

B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

C. Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications. The supplier's obligation shall include repair or replacement, and testing without charge to the owner, all or any parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier. The warranty shall commence upon the owner's acceptance of the project. Warranty on both equipment and labor shall be for a minimum period of one (1) year.

1.4 SUBMITTALS:

A. Contractor through the manufacturer of the equipment shall substantiate conformance to this specification by supplying the necessary documents, performance data and wiring diagrams. Any deviations to this specification must be clearly stated by letter and submitted.

B. Submit a lighting plan at scale 1/8" = 1'-0", or larger, clearly marked by manufacturer showing proper product, location and orientation of each sensor. For typical spaces, like small offices, a typical plan drawing will be sufficient for classrooms and other spaces submit specific plan drawings identifying each space with room number.

C. Submit standard catalog literature which includes performance specifications indicating compliance to the specification.

D. Catalog sheets must clearly state any load restrictions when used with LED drivers. However, it is the contractor and supplier responsibility to provide any and all supplementary relays circuits and wiring to make system work as intended.

1.5 SYSTEM OPERATION:

A. Factory Startup: It shall be the manufacturer's responsibility to verify all proper adjustments and train owner's personnel to ensure owner's satisfaction with the occupancy sensor system. This service shall be provided as part of work under this section.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. The listing of any manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the electrical contractor to ensure that any price quotations received and submittals made are for sensors which meet or exceed the specifications included herein.

1. Watt-Stopper
2. Leviton
3. Lutron
4. Lithonia

2.2 ULTRASONIC OCCUPANCY SENSORS:

A. The ultrasonic occupancy sensors shall be capable of detecting presence in the control area by detecting Doppler shifts in transmitted ultrasound.

B. The ultrasonic frequency shall be 25kHz at ± 0.005%. The sensor shall be precision crystal controlled and shall not interfere with each other when two or more are placed in the same area.

C. Sensor shall utilize Advanced Signal Processing to automatically adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow through the controlled space. Ultrasonic circuit shall be solid state crystal controlled.

D. Sensors of varying frequencies shall not be allowed so as to prevent sensors from interfering with each other and to assure compatibility in the event more sensors are added or units are replaced.

E. Sensor shall have a multi-directional transmitter with temperature and humidity resistant, 25kHz tuned ultrasonic receivers. Ultrasonic receivers shall be temperature and humidity resistant with less than a 6 dB shift in the humidity range of 10% to 90% and less than a 10dB shift in the temperature range of -20° to 60°C.

F. Detection shall be maintained when a person of average size and weight moves only within or a maximum distance of twelve inches either in a horizontal or vertical manner at the approximate speed of 12 inches per second. The sum of this distance, volume and speed represent the average condition ultrasonic sensors must meet in order for the lights to not go off when a person is reading or writing while seated at a desk.

G. Each sensor shall be furnished with a convenient shunt provision which will enable a custodian or building engineer to bypass the sensor in the event of failure. This bypass provision pin shall remain in the sensor and be visible from the floor as a constant reminder that the automatic function has been bypassed.

H. Sensors are to be ceiling mounted, shall not protrude more than 1.25 inches, and should blend in aesthetically with the ceiling.

I. Time delay range shall be adjustable from 15 seconds to 15 minutes.

J. Sensor shall have user-adjustable sensitivity setting.

K. Sensors shall cover 360° and up to 2000 square feet in models rated for 500, 1000 and 2000 square feet.

L. To ensure quality and reliability, sensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

M. Sensor shall be UL and CUL listed.

N. Sensor shall have a standard 5 year warranty.

O. Sensors shall have auxiliary contact for use with HVAC controls.

2.3 DUAL TECHNOLOGY OCCUPANCY SENSORS:

A. Dual Technology sensors shall be capable of detecting presence in the control area by detecting doppler shifts in transmitted ultrasound and passive infrared heat changes.

B. Sensor shall utilize Dual Sensing Verification Principle for coordination between ultrasonic and PIR technologies. Detection verification of both technologies must occur in order to activate lighting systems. Upon verification, detection by either shall hold lighting on.

C. Sensor shall have a retrigger feature in which detection by either technology shall retrigger the lighting system on within 5 seconds of being switched off.

D. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall utilize Advanced Signal Processing which automatically adjusts the detection threshold

dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.

E. Detection shall be maintained when a person of average size and weight moves only within or a maximum distance of 12 inches either in a horizontal or vertical manner at the approximate speed of 12 inches per second. The sum of this distance, volume and speed represent the average condition a dual technology sensor must meet in order for the lights to remain on when a person is reading or writing while seated at a desk.

F. Sensor shall be capable of corner mounting to a wall or ceiling in order to eliminate detection through open doorways and outside of controlled area. To provide superior small motion detection and immediate activation upon entry, coverage of both technologies must be complete and overlapping throughout the controlled area.

G. To avoid false ON activations and to provide high sensitivity to minor motion, Pulse Count Processing and Detection Signature Analysis shall be used to examine the frequency, duration and amplitude of a signal, to respond only to those signals caused by human motion.

H. Sensor shall utilize mixed signal ASIC (application-specific integrated circuit) technology, which combines analog and digital processing into one chip package, to provide immunity to RFI and EMI.

I. The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens. The lens shall be Poly IR4 material to offer superior performance in the infrared wavelengths and filter short wavelength IR such as those emitted by the sun and other visible light sources. The lens shall have grooves facing in to avoid dust and residue build up which affects IR reception.

J. To ensure high sensitivity to small motion at the desktop, the standard lens shall be 30 element with 15 layers horizontally and 4 layers vertically and shall cover up to 2000 square feet for walking motion when mounted at a ceiling height of 10 feet.

K. For accuracy, sensor shall have a DIP switch controlled, digital time delay of 30 seconds to 30 minutes.

L. Sensor shall have a DIP switch override-ON function for use in the event of a failure.

M. Sensor shall have auxiliary contact to be used for HVAC activation.

N. Each sensing technology shall have an independent sensitivity adjustment and LED indicator that remains active at all times in order to verify detection within the area to be controlled.

O. Sensor shall incorporate field-selectable logic configurations which allows for space utilization changes and/or other special field conditions.

P. To ensure quality and reliability, sensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

Q. Sensor shall have standard 5 year warranty and shall be UL and CUL listed.

2.4 PRODUCT APPLICATION:

A. Office areas smaller than 150 square feet shall use a wall switch sensor. Wall switch sensors shall be capable of detecting occupancy at desktop level up to 150 square feet. Sensors shall utilize a hard lens with a minimum of 1.0 mm thickness. Wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-on to manual-on. Provide Watt Stopper Model WA 100 or equal.

B. Office areas over 150 square feet shall utilize an ultrasonic ceiling sensor with remote power pack. Sensor shall have an internal additional isolated relay with normally open, normally closed and common outputs for use with HVAC control, data logging and other control options. Provide Watt Stopper Model Number WT600, WT1100, WT2200 or equal. Initial switch use will be for lighting only.

C. Classrooms shall use dual technology sensors and shall be mounted in the ceiling corner to avoid detection outside the controller area when doors are left open. Sensors shall have an internal addition isolated relay with normally open, normally closed and common outputs for use with HVAC control, data logging and other control options. Provide Watt Stopper Model DT200 or equal.

D. Corridors and hallways shall use ultrasonic sensors with coverage of all interior and exterior exits. Sensor package shall contain relay for interface with HVAC and lighting loads. The sensors shall be wired in parallel with the gang switch controls to allow lighting to come on if the gang switches are in the off position. Provide W1050 by Watt Stopper or P&S US1001.

E. Restroom shall use ultrasonic occupancy sensors with remote power pack. Sensor package shall contain relay for interfacing with HVAC, EMS and additional lighting loads. Provide Watt Stopper WT1100 or P&S 1001.

2.5 POWER SUPPLIES AND AUXILIARY RELAY MODULES:

A. Provide 120 and 277 volts A.C. to 24 VDC power supplies (“Power Packs”) and auxiliary relay modules (“Slave Packs”) as required to make occupancy sensor lighting control system operational.

B. Power packs consist of a transformer and high-current relay combined in one small, powerful package. The transformer of the power packs have a primary high voltage input of 120 or 277 volts, as applicable and a secondary 24VDC, 150 mA output. The secondary voltage provides operating power to the occupancy sensors. When the occupancy sensors detect motion, they electrically close an internal circuit which sends 24 VDC back to the power or slave packs which control the lighting systems.

C. Power packs shall have the following characteristics:

1. Secondary output of 150 mA.
2. UL rated 94 V-0 plastic enclosure; units are white.
3. Low voltage leads rated for 300 volts.
4. Size: 1.6” x 2.75” x 1.6” (41mm x 70mm x 41mm) with a ½ inch snap-in nipple
5. UL and CUL listing

D. Slave Packs: shall be similar to power packs except without power supply.

E. Both power packs and slave packs shall be suitable for installation in air plenum above ceiling spaces.

PART 3 - EXECUTION:

3.1 CONTROL WIRING:

A. Control wiring between sensors and controls units shall be Class II, 18-24 AWG, stranded UL Classified, CMP, TEFLON jacketed cable suitable for use in plenums, where applicable.

B. Minimum acceptable wire gauge from the circuit control hardware relays shall be #12 AWG. All 120 volts or 277 volts wiring shall be run-in conduit.

3.2 INSTALLATION:

A. It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.

B. It is the contractors' responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at the owner's facility, to verify placement of sensors and installation criteria.

C. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components.

D. Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control system.

E. The electrical contractor shall provide both the manufacturer and the electrical engineer with ten working days written notice of the scheduled commissioning date. Upon completion of the system fine tuning the factory authorized technician shall provide the proper training to the owner's personnel in the adjustment and maintenance of the sensors.

F. Set sensors to turn off lights after the following delay upon sensing the absence of occupants in the space (verify settings with Owner prior to setting delays)

1.	Classrooms	15 Minutes
2.	Conference Rooms	15 Minutes
3.	Corridors	20 Minutes
4.	Lobbies	20 Minutes
5.	Lounge	15 Minutes
6.	Private Offices	10 Minutes
7.	Toilets	30 Minutes
8.	Labs	20 Minutes
9.	Shops	20 Minutes

3.3 COMMISSIONING:

A. This contractor, and the manufacturers of the equipment and materials specified in this section, shall provide the labor, materials, equipment, services and support required by the project commissioning agent to accomplish the successful commissioning of the equipment and systems specified here.

END OF SECTION 26 09 25

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SECTION 26 22 00 – LOW VOLTAGE TRANSFORMERS (1000 VOLTS AND LESS)

PART 1 - GENERAL

1.1 SCOPE:

A. Work under this Section includes, but is not necessarily limited to: Dry type Transformers, 600 volts and below.

B. Related requirements specified elsewhere:

1. Section 26 01 40 – Noise and Vibration Control for Electrical Systems
2. Section 26 05 26 – Grounding and Bonding for Electrical Systems

1.2 APPLICABLE SPECIFICATIONS AND STANDARDS:

A. Transformers shall be third party listed.

B. Equipment specified in this Section shall meet the following specifications and standards as applicable in their current edition:

1. ANSI Standards:

a. C57.12.50-1981 - Requirements for ventilated dry-type distribution standards 1 to 500 KVA, single-phase and 15 to 500 KVA, three-phase with high voltage 601-34,500 volts, low voltage 120-600 volts.

b. C57.12.70 - Terminal markings and connections for distribution and power transformers.

c. IEEE C57.12.91 (1979) - Test code for dry-type distribution and power transformers.

d. C57.96-1981 - Guide for loading dry-type distribution and power transformers.

2. NEMA Standards:

a. Transformers
b. Dry type, Commercial Institutional and Industrial, TR27.
c. Dry type, For General Applications, ST20.
d. Dry Type, Energy Saving TP1

1.3 SHOP DRAWINGS

A. Shop drawings shall be submitted conforming to the requirements stated in Division 01 - General Requirements and supplementary general conditions for the items specified here.

B. Submit the following information with shop drawings:

1. Electrical ratings
2. Dimensions
3. Weight
4. Certified sound levels.
5. Temperature rise versus 40 deg. C. ambient temperature.

6. Insulation rating
7. Temperature rise rating
8. Installation details showing isolation pads, vibration isolators and method of attachment to concrete pad or to overhead structure or wall as applicable.

PART 2 - PRODUCTS:

2.1 WIRING TEMPERATURE RATING:

A. Products specified here shall be UL listed for connection to conductors rated 75-degree C, or higher.

2.2 VOLTAGE RATING AND TAPS:

A. Three phase transformers - 480 volts, delta primary, 120/208 volts wye secondary, 4-wire, grounded neutral. Transformers shall have not less than four taps 2-1/2 percent below rated voltage, and two taps 2-1/2 percent above rated voltage.

2.3 INSULATION:

A. Unless as otherwise noted on drawings, transformers shall have 220 degree C., Class R insulation system with 80 degree C average winding temperature rise over 40 degree C maximum ambient. Transformers of lower KVA ratings may have Class B, F or H insulation systems.

2.4 CONSTRUCTION:

A. Transformers under base bid shall be certified as NEMA TP-1 energy saving transformers. In addition, transformers rated 15 KVA and larger shall also meet NEMA ST20.

B. Transformers shall be completely enclosed in enclosures with ventilating openings complying with NEC 450.21 (B) – Exception No. 2.

C. Transformers KVA ratings shall be for continuous loading, with or without tap connections.

D. Core and coil assembly for dry type ventilated transformers shall be vacuum impregnated with non-hygroscopic, thermosetting varnish and baked. Insulation system shall be listed by UL. No splices shall be permitted in the coils.

E. Transformer core and coil assembly for ventilated transformers shall be mounted on isomode pad dampeners to isolate normal core vibrations from the case, foundation and conduit connections.

F. Transformers shall be especially manufactured for low audible noise.

2.5 MANUFACTURERS:

A. Transformers complying with this specification and manufactured by Eaton, ABB, Square D or Siemens will be acceptable.

PART 3 - EXECUTION:

3.1 CONCRETE PAD:

A. All floor mounted transformers rated 75 KVA and smaller shall be placed on 4-inch high housekeeping concrete pad. Transformers rated 112 1/2 KVA and larger installed on above-grade floors shall be mounted on 8-inch high concrete pads.

3.2 INSTALLATION AND CONNECTION

A. Secondary neutral at each dry-type transformer shall be properly grounded as a separately derived grounded system with grounding conductor run directly to cold water pipe grounding electrode, or to nearest effectively grounded structural steel member and to the power rising grounding electrode system in accordance with requirements of Section 260526. Type of wiring and installation methods shall be in accordance with manufacturer's requirements. All wiring connections to transformers shall be in raceway run as low as possible to the sides of the transformer. No field wiring shall be permitted to enter through the top of the transformer. Dry type transformers shall be installed away from walls as required by manufacturer, but not less than 6 inches off from adjacent walls for transformers 150 KVA and smaller; 12 inches off wall for larger transformers.

B. Install transformer utilizing vibration isolators as specified in Section 26 01 40.

C. Connect transformers as recommended by transformer manufacturer to accomplish voltage output specified. Connect transformers, utilizing flexible metallic conduit in lengths of not less than 36" and not more than 72".

3.3 TRANSFORMER TESTS

A. Check for required temperature rating of connecting feeder conductors prior to connection. Provide suitable conductors. Check for proper polarity prior to energizing. Check to assure proper secondary grounding connection. Make insulation tests of windings prior to energization. After energization check secondary voltage and change taps as required to achieve 208 volts, 240 or 120 volts as applicable plus 2 1/2% with no load. Check for excessive noise or hum. Tighten sheet metal screws, if applicable to reduce noise.

3.4 COMMISSIONING

A. This contractor and the manufacturer of the equipment and materials specified in this section shall provide the labor, materials, equipment, services and support required by the project commissioning agent to accomplish the successful commissioning of the equipment and systems specified here.

END OF SECTION 26 22 00

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PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. This article covers construction of all lighting and distribution panels and auxiliary panels as shown on the drawings.

B. Refer to panelboard schedule and 1-line power diagram on drawings for specific requirements of each panel.

C. All panelboards shall meet NEC Articles 384 and 373.

D. All panelboards shall be UL listed and manufactured in accordance with NEMA Standards.

E. Detail shop drawings of panelboards provided under this Section shall be submitted for Architect/Engineer approval. Shop drawings shall show bus and circuit breaker arrangement as shown on Contract Drawings.

PART 2 - PRODUCTS

2.1 GENERAL:

A. The contractor, through the manufacturer of the equipment specified here, shall review the use, details, and methods of installation of this product as indicated and shall disclose to the Architect any and all deviations from this recommended use and method of installation and shall also disclose to the Architect his recommendations for the use and method of installation of his product to achieve the intended purpose and result. Such disclosure shall be made within the time stipulated for submission of shop drawings.

2.2 MANUFACTURER:

A. All panelboards shall be the products of 1 manufacturer unless otherwise noted and shall be the standard products of Eaton, ABB, Square D, or Siemens.

B. Equipment indicated and in the specification is based on the standard products of 1 manufacturer. The Contractor shall be responsible for the space requirements of other approved manufacturers.

2.3 WIRING TEMPERATURE RATING:

A. Products specified here, including all feeder and branch circuit protective devices shall be UL listed for connection to 75 deg. C conductors, or higher.

2.4 PANELBOARDS:

A. Panelboards shall be of the dead-front safety type. The panelboard shall be provided with lugs only in the mains unless main circuit breaker or fuse switches are indicated on the drawings. Panelboard shall be provided with the size and number of single, double or triple pole branch circuits as indicated on the drawings. Circuit breakers shall be of the automatic thermal magnetic type, quick-make and quick-break for manual and automatic operation. All multi-pole breakers shall be common trip. Each panelboard shall be

provided with a copper grounding terminal busbar bonded to the cabinet or panelboard frame. Isolated ground bus shall additionally be provided when scheduled on drawings.

B. All circuit breakers shall be bolt-on, calibrated for 40 degrees C. or be ambient compensating. Circuit breakers shall have UL interruption ratings as indicated by class of circuit breakers shown on the drawings. Series rating for short circuit rating of panelboards and circuit breakers is not acceptable.

C. Circuit breakers used to protect HVAC equipment circuits shall be HACR.

D. Cabinets for branch circuit panelboards shall be minimum 20 inches wide, except otherwise noted for oversized gutters, and shall be provided with not less than 4-inch wiring gutters at the sides, top and bottom. Flush cabinets shall be provided with screw trims having adjustable trim clamps. Trims shall be fitted with hinged doors having flush combination lock and latch. All locks shall be keyed alike. One or more directory holders protected with clear plastic and metal frame as required for rendering entire directory visible shall be mounted on the inside of each door. A neatly typed directory properly identifying each circuit shall be mounted under plastic on inside of each door. Each circuit shall be identified by the type of load and the location of the load; I.E.: "Lighting Rooms 125, 127 and 128.

E. Unless otherwise specifically noted all circuit breakers in a panelboard shall have been built by the same manufacturer who built the panelboard.

F. A running directory shall be maintained during construction.

G. All exterior and interior steel surfaces of panelboard trims shall be finished with gray ANSI-61 paint over a rust-inhibiting phosphatized primer.

H. Flush mounted panelboards shall have a maximum depth of six inches.

I. Panelboards used as service equipment shall be UL labeled as "Suitable for use as Service Equipment."

J. Panelboard shall have hinged trims (door-in-door fronts).

K. Panelboard buswork shall be copper.

PART 3 - EXECUTION:

3.1 MOUNTING HEIGHT:

A. Panelboards shall be mounted so that the operating handle of the top unit does not exceed 6'-6". Panels mounted adjacent to each other shall have the top trim level.

3.2 SURFACE MOUNTED:

A. Exterior Walls: Panelboards on exterior walls shall be mounted on fabricated channel to provide minimum 1" air space between panel and wall.

B. Interior Walls: Panelboards shall be secured to wall in 4 locations using fastening devices. Refer to specifications on supporting devices for additional requirements.

C. Panelboard trims shall be flush with enclosure.

3.3 RECESSED MOUNTED:

A. Panelboards shall have not less than four 3/4" and two 1 1/4" empty conduits from cabinets to accessible point above finished ceiling.

B. Where 2 or more recessed panelboards are installed side-by-side, they shall have separate trims with separate hinged doors. Panelboard trims shall be square and align with each other. Top of trims shall be level.

C. All panelboard trims shall meet flush with wall.

3.4 NAMEPLATE:

A. Provide nameplate in accordance with Section 26 05 53. Provide nameplate describing color coding used for identification of 480/277 volts, 208/120, 240/120 branch circuits as required by NEC 210.5(C)

3.5 COMMISSIONING:

A. This contractor, and the manufacturers of the equipment and materials specified in this section, shall provide the labor, materials, equipment, services and support required by the project commissioning agent to accomplish the successful commissioning of the equipment and systems specified here.

END OF SECTION 26 24 16

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PART 1 - GENERAL

1.1 REFERENCE:

A. Wiring devices shall be as indicated and as specified below. All devices shall be UL listed and comply with NEMA WD-1.

1.2 PART NUMBERS:

A. Manufacturer's numbers listed are to establish a type and standard of quality. Any prefix and/or suffix, whether to be added or deleted to complete the number, shall be the Contractor's responsibility. This applies specifically but not exclusively to color identification, grade, and compliance with standards and specifications.

1.3 GRADE:

A. Only the highest quality device in a category (single pole toggle, conventional duplex, etc.) will be acceptable. The addition or deletion of a prefix or suffix to change the device to a lower grade will not be acceptable.

1.4 COLOR:

A. Color of devices shall be as indicated below. Refer to the Architectural Finish Plans for wall finishes and confirm the final selection of color for each device with Architect. Colors shall be that of the molding compound. Painting will not be acceptable.
   1. Provide gray devices in shop / lab areas.
   2. Outside of shop/lab areas, provide white devices on light colored walls.
   3. Outside of shop/lab areas, provide black devices on dark colored walls.

1.5 WIRING:

A. Unless noted SWO (side wired only), devices shall be back and side wired screw type terminals. Pigtails will not be acceptable unless noted otherwise.

1.6 GROUNDING:

A. All devices shall be equipped with a "hex-head" green grounding screw for grounding the device to the grounding conductor run with the circuit conductors.

1.7 WIRING TEMPERATURE RATING:

A. Each wiring device shall be UL listed for use with 75 degree C rated wire or higher.

1.8 MANUFACTURER:

A. All devices shall be by a single manufacturer unless noted otherwise or not commercially available.

B. Furnish manufacturer's data and literature for each item provided under this Section.

1.9 SAMPLES:

A. Submit one non-returnable sample of each type receptacle and plate being installed in this building.

1.10 COVER PLATES:

A. Coverplates shall accommodate the devices installed in the outlet boxes. Where more than 1 device is indicated at the same location, a multiple ganged plate shall be used. All coverplates shall be provided by the Contractor.

B. Provide a blank plastic plate on each telecommunication outlet (Telephone, data or combination thereof).

C. Plates shall be compatible with the device configuration.

D. Coverplates shall be UL listed and shall comply with Federal Specification W-P-455 and NEMA WD-1.

E. All coverplates over flush wall boxes shall meet flush with wall.

F. All coverplates shall be manufactured by a single manufacturer unless noted otherwise or not commercially available.

G. Furnish manufacturer's data and literature for each item provided under this Section.

H. Cover plates shall be stainless steel in shop/lab areas, and shall match the device color outside of shop/lab areas.

1.11 SPARE PLATES:

A. Provide 2% of plates of each type used, but not less than one (1), at end of project and turn over to Owner.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Backstabbed (quick-wired) receptacle and switches are not allowed in this project.

B. Provide wiring devices listed here and as shown on drawings from P&S, Hubbell, Bryant or A.H.

2.2 SWITCHES:

A. Switches shall comply with Federal Specification W-S-896 when commercially available.

B. Toggle switches shall be single pole, three-way, or four-way as indicated on the drawings. Switches shall be of the grounding type, with hex-head grounding screw, rated 20A., 120/277 volt, AC only. Lighted handle switches shall have neon lights of the correct voltage rating where indicated on the drawings. All switches shall have quiet operating mechanisms without the use of mercury switches. All switches shall be listed by an "approved" third-party agency, approved for the voltage and amperage indicated.

C. Manufacturer:

Device	P&S	Hubbell	Bryant
Toggle, 1-pole	PS20AC1	HBL1221	4901
Toggle, 2-pole	PA20AC2	HBL1222	4902
Lighted toggle, 1-pole			
Toggle, 3-way	PZ20AC3	HBL123	4903

2.3 RECEPTACLES:

A. Duplex receptacles shall be of the specification grade, grounding type, with nylon body arranged for back and side wiring, with separate single or double grounding terminals. Receptacles shall be straight blade, rated 20A., 125-volt and the face configuration shall conform to the NEMA Standard No. WDI.101968, and shall be "approved" third-party listed. Self-grounding or automatic type grounding receptacles are not acceptable in lieu of receptacles with separate grounding screw lugs and a direct, green insulated conductor connection to the equipment grounding system.

B. Special Devices: Provide NEMA 5-20R duplex GFI receptacle for any application where the receptacle is within 6 feet of a sink and as otherwise noted on drawings. *GFI shall comply with January 1, 2003 UL943 Revisions. SafeLock™ Protection: If critical components are damaged and ground fault protection is lost, power to receptacle is disconnected.*

NEMA CONFIGURATION	P&S	HUBBELL	ARROW-HART
5-20R	5362	5362	5362
5-30R	3802	9308	5716
5-50R	3803	9360	5711
6-20R	5862	5462	5862-S
6-30R	3801	9330	5700
6-50R	3804	9367	5709
10-30R	3860	9350	9333
10-50R	3890	7512	7987
14-20R	3820	8410	5759
14-30R	3864	9430	5744
14-50R	3894	9450	5754
14-60R	3871	9460	9460
15-20R	3821	8420	5781
15-30R	5740	8430	8430
15-50R	5750	8450	8450
15-60R	5760	8460	8460
18-20R	3822	7250	7250
18-60R	3870	7301	5515
L5-20R	L520-R	2310	6200
L5-30R	L530-R	2610	6330
L6-20R	L620-R	2320	6210
L6-30R	L630-R	2620	6340
L14-20R	L1420-R	2410	6400
L14-30R	L1430-R	2710	6510
L15-20R	L1520-R	2420	6420
L15-30R	L1530-R	2720	6520
L21-20R	L2120-R	2510	6470

L21-30R	L2130-R	2810	6610

C. Exterior Receptacles: shall be duplex NEMA 5-20R, with built-in GFI, with enclosure listed for device utilization when raining. In addition receptacle shall be listed for outdoor usage as required by NEC 2008.

2.4 WIRING DEVICE PLATES:

A. Spare Devices: Provide 2% of spare plates of each kind used.

B. Cover plates for normal power circuits in unfinished equipment rooms shall be Type 302 stainless steel, .040" thick, satin finish, smooth surface.

C. Coverplate mounting screws shall be slotted head oval screws and shall match the finish and material of the plate, and shall be furnished with the plate by the plate manufacturer.

D. Manufacturer: Coverplate shall be manufactured by Pass & Seymour, Hubbell, Sierra, or Bryant unless noted otherwise.

E. Switch and receptacle coverplates on exposed work shall be galvanized cast ferrous metal or Feraloy, standard size, and shall be single or ganged as indicated on the drawings.

F. Exterior mounted switch and receptacle plates, and those noted to be weatherproof, shall be weatherproof PVC coverplates, standard size, single or ganged as indicated on the drawings, and shall be "approved" third party listed as "raintight while in use."

2.5 ARCHITECTURAL WALLBOX DIMMERS AND RELATED SWITCHES:

A. All devices shall be U.L. listed specifically for the required loads (i.e: incandescent, fluorescent, low voltage, electronic low voltage). Manufacturer shall provide file card upon request. Universal dimmers shall not be acceptable.

B. Manufacturer shall maintain ISO 9001 certification. Provide a copy of the certificate as part of the submittal.

C. All dimmers and switches shall incorporate an air gap which shall be accessible without removing the faceplate. The air gap switch shall be capable of meeting all applicable requirements of U.L. 20 and U.L. 1472 for air gap switches in incandescent dimmers.

D. All dimmers and switches shall provide power failure memory. Should power be interrupted and subsequently returned, the lights will come back on to the same levels set prior to the power interruption. Restoration to some other default level is not acceptable.

E. Dimmers and switches shall meet ANSI/IEEE Std.C62.41-1980, tested to withstand voltage surges of up to 6000V and current surges of up to 200A without damage.

F. Dimmers and switches shall meet the U.L. 20 and U.L. 1472 limited short circuit test requirement for snap switches.

G. Dimmer control shall be linear slide. Dimmer shall provide a smooth and continuous Square Law dimming curve.

H. Dimmer shall be voltage regulated so that +10% variation in line voltage shall cause not more than a +5% variation in load voltage when dimmer is operating at 40V (5% light output).

I. Dimmers shall utilize an LC filtering network to minimize interference with properly installed radio, audio, and video equipment.

J. Dimmer control slider shall be captured.

K. Faceplate shall snap on to device with no visible means of attachment. Heat-fins shall not be visible on front of device. At locations with multiple devices, one seamless, multi-gang faceplate shall be provided. Contractor is responsible for coordination of proper backbox size and faceplate type.

L. Dimmers, switches, and faceplates shall be Lutron Nova style; or Dimmers, switches, and faceplates shall be Lutron Nova T* style; or Dimmers, switches, and faceplates shall be Lutron Vareo style. Equivalent dimmer from Leviton, Lithonia or Watt Stopper are equally acceptable. Provide all additional relays, booster power supplies, outlet boxes and wiring required to accomplish the dimming function as part of the original contract.

PART 3 - EXECUTION

3.1 ORIENTATION OF RECEPTACLES:

A. Receptacles shall be mounted vertically. Receptacles mounted over counters, back-splashes, etc., shall be mounted horizontally.

B. All vertically mounted receptacles shall be mounted with the ground slot up.

3.2 RECEPTACLE LABELING:

A. Each receptacle, in other than public lobbies and public areas of auditorium shall have a permanent label indicating circuit and panel number.

3.3 INSTALLATION OF DIMMERS

A. Dimmers shall be wired to separate individual neutral circuits.

B. Dimmers shall be mounted end to end on ganged single or double device boxes recessed in wall. Maximum number of dimmers on a single ganged assembly shall be six. When additional dimmers are required, install dimmers on two ganged assemblies, each of equal number of devices with at least 6 inches of vertical separation.

END OF SECTION 26 27 26

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SECTION 26 28 13 - FUSES (600 VOLTS OR LESS)

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. The contractor shall provide fuses as indicated and as specified herein for overcurrent protection of conductors and equipment rated 600 volts and lower.

1.2 SUBMITTALS:

A. Furnish manufacturer's catalog data for all products specified here.

1.3 WIRING TEMPERATURE RATING:

A. All products specified here shall be rated for connection to 75C wiring, or higher.

PART 2 - PRODUCTS:

2.1 FUSE DESIGN:

A. Fuses shall be UL listed and labeled.

B. All fuses shall have contact surfaces treated to maintain conductivity and tubing of dimensionally stable not degraded by extreme conditions of humidity and aridity. All fuses, unless otherwise noted shall be dual-element, time-delay type.

C. Manufacturers: Buss, Shawmut, Littelfuse, G.E. or equal.

D. Provide fuses as follows:

	CIRCUIT TYPE	FUSE TYPE
1.	Service entrance and feeder circuits 600A and less	Class RK1, UL listed, current limiting, time delay with 200K Amp interrupting rating.
2.	Motor, motor controller and transformer circuits	Class RK1, UL listed, current limiting time delay, w/200k Amp interrupting rating.

PART 3 - EXECUTION:

3.1 GENERAL

A. Provide fuse removal tool.

B. Fuses shall be of the proper voltage class corresponding to the distribution system in which it is used.

C. Fuses shall not be shipped in equipment but shall be installed prior to energizing equipment.

D. The fuse type and rating marked on fuse barrels shall be totally visible when installed.

E. All fuses installed in each fusible switch shall be of the same manufacturer size and type.

3.2 SPARE FUSES CABINET:

A. Provide wall-mounted spare fuse cabinet containing 10% of each type with a minimum of one set, class and rating used in this project. Install at the location as directed by Owner.

END OF SECTION 26 28 13

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Work included shall include but not necessarily be limited to the following:

1. Fusible safety and disconnect switches
2. Non-fusible safety and disconnect switches

1.2 SUBMITTALS:

A. Provide manufacturers catalog data for all products specified here.

PART 2 - PRODUCTS:

2.1 WIRING TEMPERATURE RATING:

A. Products specified here shall be UL listed for connection to 75-degree C conductors, or higher, and third party listed.

B. Safety Disconnect Switches: Provide fusible and/or non-fusible heavy duty safety and disconnect switches with ratings and fuse types and sizes as shown on the drawings. Provide horsepower rated switches for use as motor circuit disconnecting means, in accordance with the individual manufacturer's published ratings. For applications in excess of switch ratings provide non-automatic molded cast circuit breakers rated not less than 125% of motor full load current. Provide each switch with the following:

1. Line terminal shields
2. Visible blade
3. Non-fusible, positive, quick-make, quick-break interrupter operating mechanism.
4. Reinforced fuse clips where required.
5. Handle whose position is easily recognizable and can be multiple padlocked in the “ON” or "OFF" position.
6. Defeatable door interlocks that prevent the door from opening when the operating handle is in the “ON” position.
7. Factory installed ground lug.
8. 'R' type fuse holders

C. Enclosure: Provide these in accordance with the following schedule:

1. NEMA 1 enclosure for dry, indoor areas.
2. NEMA 3R for damp or outdoor locations
3. NEMA 4X in kitchen areas

D. Manufacturer: Provide safety/disconnect switches as manufactured by one of the following:

1. Eaton
2. Square D Company
3. General Electric
4. Siemens

PART 3 - EXECUTION

3.1 INSTALLATION OF WORKMANSHIP:

A. Enclosure: Mount switch enclosure rigidly and with proper alignment on the building structure one (1) inch off the wall and with top of enclosure 6'-6" above finished floor. Use steel supports fabricated from standard rolled structural steel shapes. Install supports in such a manner as to no block the vertical flow of air between enclosure and wall.

B. Switches shall be securely fastened to the supporting structuring or wall utilizing four 1/4 inch minimum size, bolts. Switches shall not be mounted in an inaccessible location or where passageway to the switch may become obstructed. Provide suitable angle galvanized steel supporting structure for switches when wall space is not available for support. Supporting structure shall be attached to floor slab or overslab with 3/8 inch expansion shields.

C. Wiring: Install all incoming and outgoing power circuits.

D. Fuses: Install fuses, where required, of the proper type and ratings as shown on the drawings.

E. Locate disconnect switches as close as possible to the equipment being protected, at accessible location.

F. Provide nameplate identifying equipment served and circuit serving equipment. Refer to Section 26 05 53.

END OF SECTION 26 28 16

PART 1 - GENERAL:

1.1 SCOPE OF WORK:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 01 Specification sections apply to this section.

B. The work specified here does not have any relation to lightning protection.

1.2 DESCRIPTION:

A. Provide surge protection devices (SPD) for the protection of all AC electrical circuits and electronic equipment from the effects of lightning induced voltages, external switching transients and internally generated switching transients.

1.3 REFERENCE STANDARDS AND PUBLICATIONS:

A. The latest edition of the following standards and publications shall comply to the work of this section:

1. ANSI/IEEE C84.1-1989, American National Standard for Electric Power Systems and Equipment - Voltage Ratings (60 Hertz)
2. ANSI/IEEE C62.41-1991, Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits
3. ANSI/IEEE C62.45-1992, IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits
4. Underwriters Laboratories UL 1449 Fourth Edition, Standard for Safety - Transient Voltage Surge Suppressors
5. Underwriters Laboratories, UL 1283, Standard for Safety - Electromagnetic Interference Filters
6. National Fire Protection Association, NFPA 20, 70, 75 and 780
7. IEEE Standard 142-1991, IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems (IEEE Green Book)
8. ANSI/IEEE Standard 141-1999, IEEE Recommended Practice for Electric Power Distribution for Industrial Plants (IEEE Red Book)
9. IEEE Standard 1100-1999, IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment (IEEE Emerald Book)
10. FIPS Pub 94, Federal Information Processing Standards Publication - Guideline on Electrical Power for ADP Installations
11. National Electrical Manufacturer’s Association LS-1, 1992 (NEMA LS-1)
12. MIL Standard 220A Method of Insertion-loss Measurement
13. ISO 9001:1994, Quality Systems - Model for Quality Assurance in Design, Development, Production, Installation and Servicing
14. In addition, the surge suppression system shall be rated for “Lightning” surges in accordance with UL master label requirements for lightning protection systems.

1.4 MANUFACTURER QUALIFICATIONS:

A. Products from Innovative Technology, Inc., Liebert, Current Technology, EFI, APT, Datek, Eaton, Square D or ABB are acceptable if they meet the requirements of this specification.

B. The manufacturer shall submit a written statement indicating that a factory authorized representative inspected the installation. The installing contractor shall submit a

checkout memorandum to the manufacturer. The memorandum shall indicate the date the equipment is placed into service and the actual method of installation. Submit three copies to the specifying engineer.

C. All surge protective devices for service entrance, distribution, and branch circuit protection within a facility shall be provided by a single manufacturer.

D. The manufacturer must be regularly engaged in the manufacture of surge suppression products for the specified categories for no less than ten (10) years.

1.5 WARRANTY:

A. The SPD and supporting components shall be guaranteed by the manufacturer to be free of defects in material and workmanship for a period of ten (10) years from the date of substantial completion of service and activation of the system to which the suppressor is attached. Any additional diagnostic circuits (LEDs, surge counter, etc.) must meet a warranty period of ten (10) years.

B. An SPD that shows evidence of failure or incorrect operation during the warranty period shall be replaced free of charge. Since “Acts of Nature” or similar statements typically include the threat of lightning to which the SPDs shall be exposed, any such clause limiting warranty responsibility in the general conditions of this specification shall not apply to this section. That is, the warranty is to cover the effects of lightning, single phasing, and all other electrical anomalies. The warranty shall cover the entire device, not just various components, such as modules only.

C. The installation of SPDs in or on electrical distribution equipment shall in no way compromise or violate equipment listing, labeling, or warranty of the distribution equipment.

1.6 SUBMITTALS

A. The transient voltage surge suppression submittals shall include, but shall not be limited to, the following information:

1. Data for each suppressor type indicating conductor sizes, conductor types, and connection configuration and lead lengths.
2. Manufacturer’s certified test data indicating the ability of the product to meet or exceed requirements of this specification.
3. Drawings, with dimensions, indicating SPD mounting arrangement and lead length configuration, and mounting arrangement of any optional remote diagnostic equipment and assemblies.

B. List and detail all protection systems such as fuses, disconnecting means and protective materials.

C. SPD wiring, bonding, and grounding connections shall be indicated on the wiring diagrams for each system. Include installation details demonstrating mechanical and electrical connections to equipment to be protected.

D. If requested, a sample of each suppressor type shall be submitted for use in testing and evaluation.

PART 2 - PRODUCTS

2.1 PERFORMANCE

A. SPDs shall be listed in accordance with UL 1449 Fourth Edition, Standard for Safety, Transient Voltage Surge Suppressors and UL 1283, Standard for Safety, Electromagnetic Interference Filters.

B. The SPD shall protect all modes and there shall be seven discrete suppression circuits: 3 modes connected Line to Ground, 3 modes connected Line to Neutral, and 1 mode connected Neutral to Ground for a 3-phase, 4-wire, plus ground voltage system. Line to Neutral to Ground is not an acceptable substitute for Line to Ground. Line to Neutral to Line and Line to Ground to Line (in combination) will be acceptable for Line to Line protection.

C. All SPDs must have passed the UL 1449 Fourth Edition Fault Current Test. Documentation substantiating this claim must be provided.

D. SPDs shall use a separate path to building ground; the equipment safety ground is not to be used as a transient ground path.

E. All SPDs are to be MOV based and not include SAD technology as a means of suppression.

F. The maximum continuous operating voltage (MCOV) of all components shall not be less than 125% for a 120V system and 115% for 220, 240, 277, and 480V systems.

G. Standard diagnostic features are to include green LEDs (one per phase - normally on) indicating power and suppression status and a form C dry relay contact.

H. Extended diagnostics must include an audible alarm and surge counter to be displayed on an LCD display on the front of the suppressor. The surge counter must include a reset option. The audible alarm must include a mute option. Products requiring diagnostic test kits will not be acceptable.

2.2 SERVICE ENTRANCE PROTECTION

A. The SPD for this location shall be indicated as TYPE 1 on project drawings.

B. The service entrance SPD equipment shall meet or exceed the minimum performance criteria as follows:

1. The single-impulse surge-current rating shall be a minimum of 300,000 Amperes per phase (150,000 Amperes per mode).

2. The UL 1449 fourth Edition Suppressed Voltage Rating for the following configurations shall not exceed the following:

Voltage Configuration	L-G	L-N	N-G
120/208V (3Y101)	400V	400V	400V
277/480V (3Y201)	800V	800V	800V

C. SPDs shall be of compact design. The mounting position of the SPD shall allow a straight and short lead-length connection between the SPD and the point of connection in the panelboard.

D. Visual indication of proper SPD connection and operation shall be easily viewed on the front panel of the enclosure. The indicator lights shall indicate suppression circuit status, phase status, phase loss, reduced protection level and suppression fault.

E. The SPD shall be equipped with an integral disconnect switch or be available as an option.

F. A set of normally open/normally closed Form “C” dry contacts shall be provided for remote monitoring.

G. The enclosure type shall be suitable for the environment.

H. SPDs shall be equipped with an audible alarm with mute, reset and acknowledge features.

I. The device must be certified (report to be submitted) to withstand a minimum of 20,000 Category C3 (Combination wave - 20,000 Volts - 1.2x50 :s OCV and 10,000 Amps - 8x20 :s SCC as defined by ANSI/IEEE C62.41-1991) impulses with less than 10% change in the baseline to final let-through voltage. This data must be submitted as an independently verified and certified test report.

J. The maximum value for the attenuation for the suppressor must exceed a minimum of 33 dB. All measurements for this requirement must be taken using the MIL STD 220A method and with only six (6) inches of lead length extending outside of the normal exit location of leads for the enclosure. Test results taken with leads extending past six (6) inches are not acceptable or compliant. Additional or excessive lead length used in the test setup is *NOT* acceptable.

2.3 480/277 VOLTS DISTRIBUTION PANELS AND SERVICE RATED PANELS:

A. SPD(s) for this application, if any is required on drawings, shall be indicated as SPD TYPE 2-distribution on project drawings.

B. The distribution panel SPD equipment shall meet or exceed the minimum performance criteria as follows:

1. The single-impulse surge-current rating shall be a minimum of 200,000 Amperes per phase (100,000 Amperes per mode).

2. The UL 1449 Fourth Edition Suppressed Voltage Rating for the following configurations shall not exceed the following:

Voltage Configuration	L-G	L-N	N-G
120/208V (3Y101)	400V	400V	400V
277/480V (3Y201)	800V	800V	800V

C. SPDs shall be of compact design. The mounting position of the SPD shall allow a straight and short lead-length connection between the SPD and the point of connection in the panelboard.

D. Visual indication of proper SPD connection and operation shall be easily viewed on the front panel of the enclosure. The indicator lights shall indicate suppression circuit status, phase status, phase loss, reduced protection level and suppression fault.

E. The SPD shall be equipped with an integral disconnect switch or be available as an option.

F. A set of normally open/normally closed Form “C” dry contacts shall be provided for remote monitoring.

G. The enclosure type shall be suitable for the environment.

H. SPDs shall be equipped with an audible alarm with mute, reset and acknowledge features.

I. The device must be certified (report to be submitted) to withstand a minimum of 15,500 Category C3 (Combination wave - 20,000 Volts - 1.2x50 :s OCV and 10,000 Amps - 8x20 :s SCC as defined by ANSI/IEEE C62.41-1991) impulses with less than 10% change in the baseline to final let-through voltage. This data must be submitted as an independently verified and certified test report.

J. The maximum value for the attenuation for the suppressor must exceed a minimum of 33 dB. All measurements for this requirement must be taken using the MIL STD 220A method and with only six (6) inches of lead length extending outside of the normal exit location of leads for the enclosure.

2.4 SUBPANEL PROTECTION

A. SPD(s) for this location, if any is required by drawings, shall be indicated as TYPE 3 on project drawings.

B. The sub panel SPD equipment shall meet or exceed the minimum performance criteria as follows:

1. The single-impulse surge-current rating shall be a minimum 100,000 Amperes per phase (50,000 Amperes per mode).

2. The UL 1449 Fourth Edition Suppressed Voltage Rating for the following configurations shall not exceed the following:

Voltage Configuration	L-G	L-N	N-G
120/208V (3Y101)	400V	400V	400V
277/480V (3Y201)	800V	800V	800V

C. SPDs shall be of compact design. The mounting position of the SPD shall allow a straight and short lead-length connection between the SPD and the point of connection in the panelboard.

D. Visual indication of proper SPD connection and operation shall be easily viewed on the front panel of the enclosure. The indicator lights shall indicate suppression circuit status, phase status, phase loss, reduced protection level and suppression fault.

E. The SPD shall be equipped with an integral disconnect switch or be available as an option.

F. A set of normally open/normally closed Form “C” dry contacts shall be provided for remote monitoring.

G. The enclosure type shall be suitable for the environment.

1. SPDs shall be equipped with an audible alarm with mute, reset and acknowledge features.

2. The device must be certified (report to be submitted) to withstand a minimum of 15,000 Category C3 (Combination wave - 20,000 Volts - 1.2x50 :s OCV and 10,000 Amps - 8x20 :s SCC as defined by ANSI/IEEE C62.41-1991) impulses with less than 10% change in the baseline to final let-through voltage. This data must be submitted as an independently verified and certified test report.

3. The maximum value for the attenuation for the suppressor must exceed a minimum of 33 dB. All measurements for this requirement must be taken using the MIL STD 220A method using and with six (6) inches of lead length extending outside of the normal exit location of leads for the enclosure.

2.5 MANUFACTURERS:

A. Products from Innovative Technology, Liebert, Datek, Eaton, Square D or ABB are acceptable.

PART 3 - INSTALLATION

3.1 GENERAL

A. The installing contractor shall install the parallel SPD with short and straight conductors as practically possible.

B. The contractor shall follow the SPD manufacturer's recommended installation practice as found in the equipment installation instructions.

C. The installation shall apply to all applicable codes.

3.2 COMMISSIONING:

A. This contractor, and the manufacturers of the equipment and materials specified in this section, shall provide the labor, materials, equipment, services and support required by the project commissioning agent to accomplish the successful commissioning of the equipment and systems specified here.

END OF SECTION 26 43 00

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes:

1. Interior solid-state luminaires that use LED technology.
2. Lighting fixture supports.

B. Related Sections:

1. Section 26 27 26 – Wiring Devices
2. Section 26 09 25 – Occupancy Sensor Lighting Control Systems

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 SUBMITTALS

A. Shop drawings, product data, assembly drawings, wiring diagrams, performance, maintenance data, etc. shall be submitted in accordance with the provisions of specification Section 26 01 00

B. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
6. Photometric data and adjustment factors based on laboratory tests.
    a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
    b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

C. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

D. Product Schedule: Refer to drawings for luminaires, light engines and drivers.

E. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved, as applicable:

1. Luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
4. Structural members to which equipment and or luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including the following:
    a. Other luminaires.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Ceiling-mounted projectors.
7. Moldings.

F. Qualification Data: For testing laboratory providing photometric data for luminaires.

G. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

H. Product Certificates: For each type of luminaire.

I. Sample warranty.

1.4 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.6 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty for products specified here shall be in accordance with the requirements stated in the General Condition and Supplementary Conditions of the Contract.

C. Special Warranties: Manufacturer's standard form in which manufacturer of specified lighting unit agrees to repair or replace components of such lighting unit that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 5 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining 4 years.
2. Warranty Period for LED Electronic Driver: 5 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining 4 years.
3. Warranty period for LED Luminaires: Manufacturer and luminaire distributor agree to repair or replace LED luminaires that fail during the warranty period as qualified here:
    a. The requested warranty for LED light engine and driver is a full 7-year warranty for parts and labor from the date of substantial completion.
    b. Warranty for fixture paint, lens, de-coloration or corrosion is three years from the date of substantial completion.
    c. The warranty for LED luminaires is a full warranty. The warranty is for an installation as defined by the Contract Documents for this specific building.
    d. The method of switching used for the LED luminaires shall not reduce in any way the required 7-year warranty. The switching method is as shown on the drawings.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Standards:

1. ENERGY STAR certified.
2. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
3. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
4. UL Listing: Listed for damp location.
5. Recessed luminaires shall comply with NEMA LE 4.

C. CRI of minimum 70. CCT of 3000 K or 4100 K, as indicated on drawings.

D. Rated lamp life of 50,000 hours to L70.

E. Dimmable from 100 percent to 0 percent of maximum light output.

F. Internal driver.

G. Nominal Operating Voltage: 120V to 277V, as indicated on drawings.

1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

H. Housings:

1. Extruded-aluminum housing and heat sink.
2. Finish, as indicated on drawings.

2.2 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Factory-Applied Labels: Comply with UL 1598. Locate labels where they will be readily visible to service personnel.

2.3 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.4 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with State of Virginia requirements.

B. Internally Lighted Signs:

1. Light Engine for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

a. Battery: Sealed, maintenance-free, nickel-cadmium type.
b. Charger: Fully automatic, solid-state type with sealed transfer relay.
c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

3. Master/Remote Sign Configurations:

a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in battery for power connection to remote unit.
b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 26 05 29- “Hangers and Supports for Electrical Systems” for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

B. Lighting Fixtures: Set level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Temporary Lighting: If it is necessary, and approved by Owner’s Representative, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

D. Remote Mounting of Drivers: Distance between the driver and fixture shall not exceed that recommended by driver manufacturer. Verify, with driver manufacturers, maximum distance between driver and luminaire.

E. Lay-in Ceiling Lighting Fixtures Supports:

1. Where a lighting fixture replaces ceiling tile in lay-in ceilings, support fixture with minimum of two support wires, one at opposite corner of fixture and secure fixture to ceiling grid main runners with sheet metal screw at each corner of the fixture. It is the responsibility of the Division 26 Contractor to arrange with the ceiling installer for the proper location of ceiling grid main runners to accomplish fixture attachments.
2. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
3. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

F. Suspended Lighting Fixture Support

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Connect wiring according to Section 26 05 19 – “Low Voltage Electrical Conductors”.

H. Identification

1. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 26 05 53 – “Identification of Electrical Systems.”

3.2 FIELD QUALITY CONTROL

A. Start-Up Service

1. Burn-in all light fixtures that require specific aging period to operate properly, prior to occupancy by the Owner. Burn-in LED luminaires intended to be dimmed, for at least 100 hours at full voltage.

B. Adjusting

1. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this Work may be required after dark.

a. Adjust aimable luminaires in the presence of Owner’s Representative.

END OF SECTION 26 50 00

PART 1 - GENERAL:

1.1 DESCRIPTION OF WORK:

A. Exterior site light fixtures including luminaries, concrete bases and grounding provisions.

1.2 GENERAL:

A. Requirements of the Contract Documents apply to all work in this Section.

B. All referenced manufacturer's requirements and specifications and nationally recognized and accepted standards and specifications shall be the latest edition unless specified otherwise and shall be used as they are applicable for products and craftsmanship incorporated in the Contract Drawings and this Section only. The references to these standards and specifications do not imply acceptance of any and all products described in the standards and specifications.

C. The contractor through the manufacturer of the equipment shall review the use, details, and method of installation of his product as indicated and shall disclose to the Architect any and all deviations from his recommended use and method of installation and shall also disclose to the Architect his recommendations for the use and method of installation of his product to achieve the intended purpose and result. Such disclosures shall be made within the time stipulated for submission of shop drawings.

D. Provide all material and furnish all labor for the complete electrical work as specified, indicated, and as required for the complete and proper performance of the products and systems.

E. Provide luminaires rated to withstand up to 150 MPH sustained winds. Provide concrete bases and anchoring capable to anchor the luminaires ("light bollards") during hurricane force winds as specified above.

1.3 WARRANTY:

A. For a period of one year after the project acceptance, and at no additional cost, the contractor shall promptly provide and install replacements for luminaires or components thereof which, in the opinion of the contracting officer are defective in materials or workmanship; or contractor shall repair installed equipment at the job site to the contracting officer's satisfaction. For any time during the warranty period that luminaires are not fully functional due to defects in materials or workmanship, the contractor shall provide or pay for and install and remove suitable and adequate temporary lighting. The contractor also warrants replacement luminaires or components to be free of defects in workmanship or materials for a period of one year following replacement, and shall replace any defective replacements.

B. The contractor shall provide products of firms regularly engaged in the manufacture of exterior luminaires or components of similar types and ratings to those required. Such similar products shall have been in satisfactory use in similar applications for not less than two years.

1.4 SUBMITTALS:

A. For all lighting fixtures including special fixtures and other equipment specified in this Section, submit lighting brochure indexed alphabetically in accordance with fixture identification on drawings, tabbed for each fixture, and clearly identifying the catalog numbers for each item of equipment and special features for each item.

B. Submit chips for all finishes and colors noted on the schedule to be selected by the Architect. Chip shall be minimum 4” x 4” and shall be a true sample of the finish on the fixture material and not merely the color. Submittal shall include a complete description of the finishing process.

PART 2 - PRODUCTS:

2.1 GENERAL:

A. Products specified are for establishing the type, design and quality required. Products of equal type, design and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with DIVISION I - GENERAL REQUIREMENTS.

B. Exterior lighting shall include but shall not be limited to:

1. Luminaires
2. Light Engines
3. Drivers
4. Special controls
5. Fixture mounting brackets
6. Concrete pole bases and anchor bolts
7. Branch circuit wiring and conduit
8. Installation, connection and setting of above equipment
9. Final adjustments

2.2 POLES FOR EXTERIOR LIGHTING FIXTURES:

A. Provide high-strength anchor bolts rated to support fixture during specified hurricane winds.

B. Each anchor bolt shall be provided with leveling nut, holddown nut and washers. Nuts and washers shall be stainless steel. Leveling shims in lieu of leveling nuts will be acceptable.

C. Concrete Bases for Lighting Bollards:

1. Concrete shall have a 28-day strength of at least 3000 psi and a maximum slump of 4”. Concrete shall not be used which has had water added to mix for more than 1 hour before placement. At least 4 concrete test cylinder specimens shall be made from each day’s pour.
2. Reinforcing steel bars shall be ASTM A 615-68, Grade 60. Bond reinforcing bars to grounding rod and to pole base.
3. All anchor bolts, nuts, washers, and templates shall be supplied by the pole manufacturer and installed in this Section in accordance with pole manufacturer's

instructions. The use of these products from any other manufacturer will not be permitted.

PART 3 - EXECUTION:

3.1 COMMISSIONING:

A. This contractor, and the manufacturers of the equipment and materials specified in this section, shall provide the labor, materials, equipment, services and support required by the project commissioning agent to accomplish the successful commissioning of the equipment and systems specified here. Refer to Commissioning specifications for additional requirements.

END OF SECTION 26 56 00

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PART 1 - GENERAL

1.1 RECORD DRAWINGS

A. The Electrical contractor shall keep a record copy of the bid set and fabrication drawings at the job site and shall accurately maintain a record with dimensions and elevations of all changes to the contract drawings as the job progresses. At the completion of the job, the electrical contractor shall obtain a sepia reproducible from the Architect and shall make changes which occurred during construction on drawings and submit three (3) copies to the Engineer. The Engineer will check drawings and will return them to contractor with comments or statement of approval, as applicable.

1.2 DEMONSTRATION OF COMPLETE ELECTRICAL SYSTEMS:

A. After installation has been completed, equipment has been tested, systems placed in permanent operation, and all adjustments made, a competent start-up technician shall be provided for a period of two working days. This technician shall operate the systems during this time, and during this time shall instruct the Owner's designated representatives in the operation and maintenance of the equipment. The start-up technician shall be at the site continuously during working hours during the instructional period.

1.3 OPERATING AND MAINTENANCE MANUALS:

A. The form in which the operating maintenance manual is to be presented shall be subject to approval by the Architect.

B. The following items, together with any other necessary and pertinent data, shall be included in the manual. This list is not necessarily complete and is only to be used as a guide.

C. Settings of all control and switches for normal operation with description of control and its location.

D. A check list for periodic maintenance of all equipment, with maintenance and cleaning instructions.

E. As built wiring diagrams, interlock, and control diagrams for the equipment.

F. Parts list for all replaceable service parts, and indicate where they may be purchased.

G. Manufacturer's cuts and rating tables for all equipment, including copies of all factory record drawings and all other shop drawings.

H. Test data on all equipment.

I. Serial numbers of all principal pieces of equipment.

J. Manufacturers', suppliers, and subcontractors' names, addresses, and telephone numbers.

K. The first page shall identify project and give name, address and phone number of Architect, Engineer, Mechanical and Electrical sub-contractors and any service

companies involved and give name and night phone of each party responsible for service.

1.4 WARRANTIES:

A. Deliver to Owner all warranties, guarantees, etc. and obtain written receipts.

1.5 PUNCH LIST:

A. During construction period the A/E will issue punch lists. These items shall be completed before A/E will approve next application for payment. Final punch list work shall be completed before acceptance.

1.6 FINAL INSPECTION AND ACCEPTANCE:

A. The architect or his authorized representative will entertain the request for final inspection and acceptance only after the following items are done.

B. Submit a list of uncompleted items, if any, and advise when the items will be done.

C. Complete all items on A/E's prefinal punch list.

1.7 FINAL CLEAN UP:

A. During construction this contractor shall keep the site clear of debris and upon completion of construction he shall clean up the premises and to remove all evidence of his work.

B. The contractor shall resolve all questionable items to be corrected prior to an inspection by the Engineer. If items have not been corrected completely, and additional site visits are required for the Engineer to check for compliance, the contractor will be billed by the Owner at $125.00 per hour plus travel expenses for Engineer's services.

1.8 GUARANTEE:

A. The guarantee shall be as stated in the General Conditions, and the General Provisions of this section.

1.9 CLOSE-OUT CHECK LIST:

A. Provide, perform and submit all the items included in the following close-out list.

Section	Item	Action
26 01 00	Factory Record Drawings: . Transformers . Panelboards	Submit
26 01 00	Certificate of Inspection by Code Authority	Submit
26 01 00	Certificate of Completion	Submit
26 01 00	Remove all debris and clean: . Light Fixtures . Lenses . Equipment Interiors . Electrical Rooms . Interior of Panels	Perform
26 01 00	Operation and Maintenance Manuals	Submit

Section	Item	Action
26 01 00	Equipment Warranties: A list of warranty contacts (names, addresses and phone numbers) must be submitted for each electrical item.	Submit
26 01 00	Factory Record Drawings	Submit, including site plan with dimensioned circuit runs.
26 02 35	600 Volt Cable Test Report	Submit
26 02 35	Feeder continuity and fault test	Submit
26 05 31	Sealing of incoming conduits	Perform/Verify
26 05 53	Equipment Nameplates	Provide on all equipment.
26 09 25	Occupancy Sensor Lighting Control System Commissioning	Perform
26 22 00	Transformer Test Results	Submit
26 24 16	Panelboard Circuit Directory	Complete and Install
26 24 16	Keys to owner	Submit
26 27 26	Receptacle Test	Perform/Verify
26 28 13	Spare Fuse Cabinet	Furnish and Install
26 43 00	SPD Test Reports	Submit
26 50 00	Light Fixture Extra Lenses	Provide/Verify
26 50 00	Clean Light Fixtures, Lenses.	Perform
28 31 00	Fire Alarm System Personnel Instruction	Perform
28 31 00	Fire Alarm System Personnel Instruction Written Statement	Submit
28 31 00	Fire Alarm Acceptance Tests	Perform
28 31 00	Fire Alarm Test Reports	Submit
28 31 00	Fire Alarm System: Posting of Record Drawings	Perform/Verify

END OF SECTION 26 90 00

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Magnetic door holders.
7. Remote annunciator.
8. Digital alarm communicator transmitter.

1.3 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FACP: Fire Alarm Control Panel.

C. NICET: National Institute for Certification in Engineering Technologies.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.

7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.

    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring required for HVAC unit shutdown on alarm.
12. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified, fire-alarm technician; Level III minimum.
    c. Licensed or certified by authorities having jurisdiction.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Data: Certificates, for fire-alarm control unit, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
d. Riser diagram.
e. Device addresses.
f. Record copy of site-specific software.
g. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

1) Equipment tested.
2) Frequency of testing of installed components.
3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.

h. Manufacturer's required maintenance related to system warranty requirements.
i. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.

C. Automatic sensitivity control of certain smoke detectors.

D. All components provided shall be listed for use with the selected system.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Automatic sprinkler system water flow.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Close smoke dampers in air ducts of designated air-conditioning duct systems.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
2. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in internal circuits of fire-alarm control unit.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
3. Record the event on system printer.
4. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2.4 FIRE-ALARM CONTROL UNIT

A. Subject to compliance with the specifications, the following are approved for bid:

1. Edwards System Technologies
2. Notifier
3. Siemens
4. Fire Control Instruments
5. ABB

B. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.

a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
b. Include a real-time clock for time annotation of events on the event recorder and printer.
c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
d. The FACP shall be listed for connection to a central-station signaling system service.

e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.

2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

D. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, three line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

E. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1. Pathway Class Designations: NFPA 72, Class A.
2. Pathway Survivability: Level 1.
3. Install no more than 50 addressable devices on each signaling-line circuit.
4. Serial Interfaces:

a. One dedicated RS 485 port for central-station operation using point ID DACT.
b. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).

F. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

G. Notification-Appliance Circuit:

1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

H. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall be connected to fire-alarm system.

I. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

J. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

K. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also, print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

L. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

M. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

N. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.5 MANUAL FIRE-ALARM BOXES

A. Subject to compliance with the specifications, the following are approved for bid:

1. Notifier
2. Siemens
3. Wheelock
4. Gamewell
5. ABB

B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.

2. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with attached addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
3. Station Reset: Key- or wrench-operated switch.
4. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
5. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.6 SYSTEM SMOKE DETECTORS

A. Subject to compliance with the specifications, the following are approved for bid:

1. Notifier
2. Siemens
3. Gamewell
4. ABB
5. Gentex

B. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

    a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 F per minute.
    b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 deg F.
    c. Multiple levels of detection sensitivity for each sensor.
    d. Sensitivity levels based on time of day.

C. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.

c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

D. Ionization Smoke Detector:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

a. Primary status.
b. Device type.
c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

E. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

a. Primary status.
b. Device type.
c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.7 HEAT DETECTORS

A. Subject to compliance with the specifications, the following are approved for bid:

1. Notifier
2. Siemens
3. Gamewell
4. ABB
5. Gentex

B. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

C. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.8 NOTIFICATION APPLIANCES

A. Subject to compliance with the specifications, the following are approved for bid:

1. ABB
2. Siemens
3. Wheelock
4. Gentex

B. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.

C. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

D. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

E. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.

1. Rated Light Output:
   a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, white.

2.9 MAGNETIC DOOR HOLDERS (If Any)

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnets: Require no more than 3 W to develop 25-lbf holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24-V ac or dc.
4. Rating: 120-V ac.

B. Material and Finish: Match door hardware.

2.10 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.11 ADDRESSABLE INTERFACE DEVICE

A. General:

1. Include address-setting means on the module.
2. Store an internal identifying code for control panel use to identify the module type.
3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Control Module:

1. Operate notification devices.
2. Operate solenoids for use in sprinkler service.

2.12 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.
8. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.13 SYSTEM PRINTER

A. Printer shall be listed and labeled as an integral part of fire-alarm system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, The International Mechanical Code - 2015, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before all other trades have completed cleanup shall be replaced.
2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

B. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.

C. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.

D. Smoke- or Heat-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed **30 feet.**
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A in NFPA 72.
5. HVAC: Locate detectors not closer than **36 inches** from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

E. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

F. Duct Smoke Detectors: Comply with NFPA 72 and The International Mechanical Code - 2015. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

G. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.3 PATHWAYS

A. Pathways shall be installed in EMT.

3.4 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.6 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.7 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by North Carolina SCO and Engineer of Record for the project.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.8 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.9 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 28 31 00

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SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Adjust list below to suit Project.
   2. Protecting existing trees, shrubs, groundcovers and grass to remain.
   3. Removing existing trees, shrubs, groundcovers and grass.
   4. Clearing and grubbing.
   5. Stripping and stockpiling topsoil.
   6. Removing above- and below-grade site improvements.
   7. Disconnecting, capping or sealing, and removing site utilities.
   8. Temporary erosion and sedimentation control measures.

B. Related Sections include the following:
   1. List below only construction that the reader might expect to find in this Section but is specified elsewhere.
   2. Division 01 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities and temporary erosion and sedimentation control procedures.
   3. Division 01 Section "Temporary Tree and Plant Protection" for protecting trees remaining on-site that are affected by site operations.
   4. Division 01 Section "Execution" for verifying utility locations and for recording field measurements.
   5. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.
   6. Division 23 Section "Turf and Grasses, Plants" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps,

gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. Record drawings, according to Division 01 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

C. Location plan of staging areas and schedule for moving staging equipment into those areas shall be submitted for Owner’s Representative's approval prior to mobilization and related site preparation operations.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

B. Before the start of any work on the site, preceding the arrival of equipment, materials or vehicles to the site, and prior to the commencement of any clearing on the site, the Contractor shall arrange a preconstruction conference on the site with the Owner’s Representative to identify trees and shrubs that are to be protected or removed. Do no clearing without a clear understanding of existing conditions to be preserved. In addition to the responsibilities and penalties described in this Part of the Specification, the Contractor shall be held responsible for any and all clearing, damage or destruction to plant material that results from the Contractor’s failure to schedule and attend the preconstruction conference on site. In the event of said clearing, damage or destruction the Contractor will be assessed the full penalties described in this Division 31 Section, SITE CLEARING.

C. Before the start of any work on the site, preceding the arrival of equipment, materials or vehicles to the site, and prior to the commencement of any clearing on the site, the Contractor shall contact a hospital preferred arborist to communicate the construction schedule and to coordinate the removal by the hospital preferred arborist of any plant material that it wishes to remove for transplanting.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
   1. Do not proceed with work on adjoining property until directed by Designer.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

1.8 LIABILITY FOR DAMAGES

A. The Contractor shall be liable for all damage and/or disturbance to existing trees and shrubs not otherwise designated for removal. For bidding and general work guidelines prior to on-site tree protection conference, the Contractor shall assume all trees within the Limit of Work shall be saved unless specifically designated to be removed on the Plans. Actual charges for damage to plants shall be in accordance with the schedules defined herein, with assessed charges to be deducted from sums payable under the Construction Contract.

   1. Damage which, in the Owner’s Representative’s opinion, can be remedied by corrective maintenance shall be repaired immediately.
   2. Trees or shrubs which are damaged irreparably shall, at the Owner’s Representative’s discretion, be replaced by the Contractor with new trees or shrubs of the same size and type.
   3. In the event that replacement of damaged trees is not feasible or impractical as determined by the Owner’s Representative, the full replacement costs will be assessed to the Contractor’s account at values based upon the square inches of cross sectional area of trunk (measured at 4 ft. (1.22 m) above grade), in accordance with the Trunk Formula Method described in the ISA Guide described herein, and the following table:

      $75.00/square inch for trees less than or equal to 6 inch diameter

$50.00/square inch for trees greater than 6 inch and less than 18 inch diameter $40.00/square inch for trees greater than or equal to 18 inch diameter

B. Damaged trees or shrubs that require removal and/or replacement shall be removed according to the Specification requirements for removals, including refilling and repair of ground surface, with such costs to be borne by the Contractor in addition to assessed charges described herein.

C. The Contractor shall be liable for all damage and/or disturbance to existing adjacent lands beyond the Limit of Work. Actual damage to these areas, caused by the Contractor, shall be repaired to the satisfaction of the Owner's Representative, at no additional cost to the Owner. Repairs may include pruning or removing damaged vegetation, replacement of damaged vegetation, decompaction of soil and subsoils, restoration of the ground plane to its original condition, and any other work required to restore the area to its original condition as depicted in the site photographs taken at the beginning of construction. The project will not be accepted until all repair work is complete.

D. Trees or roots visibly damaged will cause the Owner to withhold from the Contractor an assessed amount conforming to the requirements stipulated above for a period of two years. After that period the impact of the damage to any tree will be assessed accordingly.

E. Visible damage to the tree trunks or to tree roots within the protected areas will cause the Owner to withhold from the Contractor an amount in accordance with and as described under Paragraph titled, Liability for Damages, in this Division 31 Section, SITE CLEARING, for a period of two years. After that period the impact of the damage will be assessed by the Owner's Representative and Owner, If in the opinion of the Owner's Representative or Owner, the tree is in fair to good health the damage fine will be refunded; if the tree is in poor condition or lost the fine will not be refunded.

PART 2 - PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earth Moving."

1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - PART 3 EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated. Prior to starting site clearing operations, stake out all areas of trees and shrubs to be saved as noted on the Contract Documents for approval by the Owner's Representative.

C. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

A. Erect and maintain temporary fencing around tree and planting protection zones before starting site clearing. Remove fence when construction is complete.
   1. Do not store construction materials, debris, or excavated material within fenced area.
   2. Do not permit vehicles, equipment, or foot traffic within fenced area.
   3. Maintain fenced area free of weeds and trash.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Damage no plants to remain by burning, by pumping of water, by cutting of live roots or branches, or by any other means. No plants to be saved shall be used for crane stays, guys or other fastenings.

D. Vehicles shall not be parked within the dripline or where damage may result to trees to be saved. Construction materials shall not be stored beneath trees to be saved.

E. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
   1. Cover exposed roots with burlap and water regularly.
   2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
   3. Backfill with soil as soon as possible.

F. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Designer.
   1. Employ an arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
   2. Replace trees that cannot be repaired and restored to full-growth status, as determined by Designer.

3.4 UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
   1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
   1. Arrange with utility companies to shut off indicated utilities.
   2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Construction Manager not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Construction Manager's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

E. Removal of underground utilities is included in Sections covering site utilities.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
   3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches (450 mm) below exposed subgrade. Stumps shall be removed to their full depth. Roots 3 inches (75 mm) and larger shall be removed to a depth of 2 feet (0.60 m) below finished grade. Stumps shall be legally disposed of off-site.
   4. Use only hand methods for grubbing within tree protection zone.
   5. Chip removed tree branches and dispose of off-site.

6. Fell trees in such a way as to not injure trees to be saved.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Revise paragraph and subparagraphs below if topsoil is to be removed from site.

D. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
   2. Do not stockpile topsoil within tree protection zones.
   3. Dispose of excess topsoil as specified for waste material disposal.
   4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

C. The Contractor will be given the option of removing asphalt pavement and base from the site or reclaiming existing asphalt pavement and base to full depth for reuse on site. The work of removing asphalt pavement from the site or reclaiming asphalt pavement shall be as specified and paid for under the work of this Division 31 Section, SITE CLEARING.

3.8 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
   1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

B. Material resulting from the site preparation work and not scheduled to be salvaged and which is unsuitable for reuse on the project, shall become the property of the Contractor and shall be legally disposed of off-site.

C. Debris, rubbish, and other material shall be disposed of promptly and shall not be left until final cleanup of site.

D. Existing site structures indicated on the Contract Documents to be removed, shall be completely dismantled and removed from the site.

E. Areas formerly occupied by structures shall be regraded to conform to surrounding topography following demolition.

END OF SECTION 31 10 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and exterior plants.
3. Subbase course for concrete walks pavements.
4. Subbase course and base course for asphalt paving.
5. Subsurface drainage backfill for walls and trenches.
6. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:

1. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
2. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
3. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.
4. Section 334600 "Subdrainage" for drainage of foundations, slabs-on-grade, walls and landscaped areas.

C. Retain "Rock Measurement" Paragraph below for classified excavation. Measurements are examples only; revise dimensions to suit Project conditions and office standards. Consider separate unit prices for open rock excavation and trench rock excavation.

D. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.

1. 24 inches outside of concrete forms other than at footings.
2. 12 inches outside of concrete forms at footings.
3. 6 inches outside of minimum required dimensions of concrete cast against grade.
4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.

1.3 DEFINITIONS

A. Retain definitions remaining after this Section has been edited. Revise to suit office or local earth-moving practices.

B. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

C. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

D. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

E. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Designer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices and changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Designer. Unauthorized excavation, as well as remedial work directed by Designer, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock-excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Equipment for Footing, Trench, and Pit Excavation: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- maximum-width, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,090 lbf and stick-crowd force of not less than 18,650 lbf; measured according to SAE J-1179. (i.e. CAT 320 hydraulic excavator or comparable equipment.)
2. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732. (i.e Caterpillar's "Model No. 973C or comparable equipment.)

I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.

J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

K. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

L. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

M. Unsuitable Soil: Soil that is unsatisfactory or not suitable for obtaining the compaction requirements specified in this Section. Soils are not unsuitable due to moisture content. Soils containing greater than 4 percent organic material by weight is considered unsuitable soil for use as structural fill.

N. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct pre-excavation conference at Project site.

1. Review methods and procedures related to earthmoving, including, but not limited to, the following:
   a. Personnel and equipment needed to make progress and avoid delays.
   b. Coordination of Work with utility locator service.
   c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
   d. Extent of trenching by hand or with air spade.
   e. Field quality control.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Controlled low-strength material, including design mixture.
3. Each type of warning tape.

B. Samples for Verification: For the following products, in sizes indicated below:

1. Geotextile: 12 by 12 inches.

2. Warning Tape: 12 inches long; of each color.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Determine Liquid Limit, Plastic Limit and Plasticity Index, according to ASTM D 4318, to establish engineering properties of on-site and borrow soil material proposed for fill and backfill.
2. Classification according to ASTM D 2487.
3. Laboratory compaction curve according to ASTM D 698.

C. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.7 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Retain "Improvements on Adjoining Property" Paragraph below to suit Project; coordinate with Owner.

C. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Designer.

D. Retain "Utility Locator Service" Paragraph below if required and not specified in Section 311000 "Site Clearing"; revise to suit Project. First option is a generic term that is known in various states by different names listed in the other options. See Evaluations.

E. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations.

F. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 015000 "Temporary Facilities and Controls" and Section 311000 "Site Clearing" are in place.

G. Retain first paragraph below if protection zones and protection-zone fencing are required.

H. Do not commence earth-moving operations until plant-protection measures are in place.

I. Retain three paragraphs below if tree- or plant-protection zones are required.

J. The following practices are prohibited within protection zones:

1. Revise subparagraphs below to suit Project.
2. Storage of construction materials, debris, or excavated material.
3. Parking vehicles or equipment.
4. Foot traffic.
5. Erection of sheds or structures.
6. Impoundment of water.
7. Excavation or other digging unless otherwise indicated.
8. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

K. Do not direct vehicle or equipment exhaust towards protection zones.

L. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Revise "Satisfactory Soils" and "Unsatisfactory Soils" paragraphs below and identify soil materials according to geotechnical engineer's written recommendations. Revise soil groups and size of stone to suit Project. Most soils are classified according to ASTM D 2487. Heavy civil or highway projects may use AASHTO M 145.

Commented [DB1]: I think this is meant to come out

C. Satisfactory Soils: Soil Classification Groups GC, ML, SC, CL, GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

1. Liquid Limit: Less than 40, unless otherwise recommended in a site specific geotechnical report.
2. Plasticity Index: Less than 20, unless otherwise recommended in a site specific geotechnical report.

D. Unsatisfactory Soils: Soil Classification Groups OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups and other materials not meeting the criteria of Section 2.1B, unless otherwise recommended in a site specific geotechnical report or permitted by the Project's testing agency.

E. Subbase Material, Base Material, and Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand, recycled concrete as approved by the testing agency, or other approved hard, durable material per ASTM D 2940/D 2940M; and conforming to the gradation limits as follows:

1. Sieve Size — Percent Passing (by weight)
   a. 1-1/2 inch: 100
   b. 1 inch: 75-97
   c. 1/2 inch: 55-80
   d. No. 4: 35-55
   e. No. 10: 25-45
   f. No. 40: 14-30
   g. No. 200: 4-12
2. Note: Material passing the No. 40 sieve to have a L.L. of 30 or less and a P.I. of 6 or less.

F. Bedding Course, Pipe Bedding, and Initial Backfill: : Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; and conforming to the gradation limits as follows:

1. Sand or sand with gravel mixture in which the gravel is either pea gravel (No. 78) or crushed stone without sharp edges.
2. #67 Stone,
3. #57 Stone
4. Ninety (90) percent of the material passing a No. 2 sieve.
5. Ninety (90) percent retained by a No. 200 sieve.
6. Dimensions of Bedding Course, Pipe Bedding, and Backfill: As indicated on the Drawings.

G. Flowable Concrete Fill: Flowable fill mixed in proportions approved by the North Carolina Department of Transportation and based on laboratory trial batches meeting the following requirements:

1. Compressive strength @ 56 days: 150 psi min.
2. Approximate Quantities per cubic yard:
   a. Cement: As required.
   b. Fly Ash: As required.
   c. Fine Aggregate: As required.
   d. Water: As required.

H. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and zero to 5 percent passing a No. 4 sieve.

I. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

J. Sand: ASTM C33; fine aggregate, natural, or manufactured sand.

K. Topsoil: For areas not covered by building, drives, parking lots, walks or other hard surfaces, provide topsoil consisting of friable, fertile soil of loamy character, containing an amount of organic matter normal to the region, capable of sustaining healthy plant life, and reasonably free from sub-soils, roots, heavy or stiff clay, stones larger than 1 inch in greatest dimension, noxious weeds, sticks, brush, litter, and other deleterious matter. Obtain topsoil from sources within the project limits, or provide imported topsoil obtained from sources outside the project limits, or from both sources.

2.2 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Revise colors below to comply with local practice or requirements of authorities having jurisdiction.
2. Red: Electric.
3. Yellow: Gas, oil, steam, and dangerous materials.
4. Orange: Telephone and other communications.
5. Blue: Water systems.
6. Green: Sewer systems.
7. Install identification tape 18 inches to 30 inches above utility line and a minimum of 10 inches below finished grade.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface as specified in Section 311000 "Site Clearing."

C. Protect and maintain erosion and sedimentation controls during earth-moving operations as specified in Section 311000 “Site Clearing.”

D. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

Commented [DB2]: "Dewatering" implies lowering the groundwater table. Is this how it's presented in masterspec?

3.3 EXPLOSIVES

A. Retain one of two "Explosives" paragraphs below. Retain second paragraph if explosives are permitted.

B. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as unsuitable soil, earth and rock. Do not excavate rock and unsuitable soil until it has been classified and cross sectioned by Owner. The Contract Sum will be adjusted for rock or unsuitable soil excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Revise description in first subparagraph below if removal of surface features and underground utility structures is specified in Section 024116 "Structure Demolition" or Section 311000 "Site Clearing."

Commented [DB3]:

2. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.
   a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
3. Unsuitable Soil:
   a. Unsuitable soil shall be defined as that which is unsatisfactory or not suitable for obtaining the compaction requirements specified in this Section; however, soils shall not be rendered unsuitable due to moisture content.
   b. Unsuitable soil will be measured and verified by the testing Agency by measuring the excavated dimensions. Removal of quantities compensated at the unit price quoted in the bid form.
4. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:

a. Measurements in subparagraphs below are examples only; revise to suit Project conditions and office standards and coordinate with rock measurement for unit prices, if any.

b. 24 inches outside of concrete forms other than at footings.

c. 12 inches outside of concrete forms at footings.

d. 6 inches outside of minimum required dimensions of concrete cast against grade.

e. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit unless otherwise indicated.

C. Trench Bottoms for PVC or Similar Material Piping: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms for Ductile or Concrete Piping: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.

3.7 SUBGRADE INSPECTION

A. Notify testing agency when excavations have reached required subgrade.

B. If testing agency determines that unsatisfactory soil is present, continue excavation and replace are commended with compacted backfill or fill material meeting the requirements of Section 2.1B.

C. Proof-roll subgrade below the building slabs and pavements with pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet, saturated, or frozen subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons, unless otherwise deemed acceptable to testing agency.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by testing agency, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices or changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Designer or testing agency, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Designer.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Designer.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Revise subparagraphs below to suit Project.
2. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
3. Surveying locations of underground utilities for Record Documents.
4. Testing and inspecting underground utilities.
5. Removing concrete formwork.
6. Removing trash and debris.
7. Removing temporary shoring, bracing, and sheeting.
8. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

D. Trenches under Roadways: Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

E. Provide 4-inch-thick, No. 57 stone or similar base for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely en-

case piping or conduit in a minimum of 4 inches of concrete above top of pipe before backfilling or placing roadway subbase.

F. Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
   1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Backfill voids with satisfactory soil while removing shoring and bracing.

H. Initial Backfill:
   1. Soil Backfill: Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
      a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

I. Final Backfill:

   1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

J. Warning Tape: All underground lines outside building footprint, except lawn irrigation lines, shall be required to have a warning tape installed in the backfill between 6 inches to 24 inches below finished grade directly over piping. Install per requirements specified in Article 2.2A of this Section.

   1. Metallic lines shall be identified with durable printed plastic warning tapes, minimum 3 inches wide with lettering to identify buried line below.
   2. Non-metallic pipes, other than gas lines, shall be identified by detectable warning tape, minimum 2 inches wide, with lettering to identify buried line below.

3.12 SOIL FILL

A. Bench sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, use satisfactory soil material.
   3. Under steps and ramps, use satisfactory soil material.
   4. Under building slabs, use satisfactory soil material.
   5. Under footings and foundations, use satisfactory soil material.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 3 percent of optimum moisture content. However, for sands containing 5 percent or less fines, moisture contents up to 5 percent are satisfactory provided that the soil can be compacted to a stable condition and meet the compaction specifications herein.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

2. Do not place backfill or soil material on surfaces until deemed satisfactory by testing agency.
3. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds the criterion in Section 3.13A, unless otherwise allowed by testing agency. Similarly, wet or add water to soils that are drier that the criterion in Section 3/13A.
4. If Contractor elects to remove and replace otherwise suitable soil that exceeds the required moisture content in lieu of aerating or otherwise drying the soil, it shall be done at the contractors expense and will not warrant additional compensation.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by smaller remote-controlled and hand-operated tampers.

B. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. For all structural fill, compact to a minimum of 95 percent of maximum dry density at elevations greater than 12 inches below finished subgrade, unless otherwise allowed by the testing agency. In the upper 12 inches, compact all structural fill to a minimum of 98 percent of maximum dry density, unless otherwise allowed by the testing agency.
2. Under walkways, compact each layer of backfill or fill soil material at 95 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
4. At pond berms and/or dams, compact each layer of backfill or fill material at 95 percent of maximum dry density.
5. Place planting soil (Turf) to depth per soils plan and specifications and compact each layer at 75 - 85 percent of maximum dry density.
6. Under and around existing utilities, provide compaction equal to that specified for new work listed above. If compaction under existing utility lines

cannot be provided due to the width of pipe or conduit, backfill with flowable concrete fill.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1/4 inch.
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.16 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Specified in Section 334600 "Subdrainage."

B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Consolidate each filter material layer with a minimum of two passes of a plate-type vibratory compactor.

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer with a minimum of two passes of a plate-type vibratory compactor.
2. Place and compact impervious fill over drainage backfill in 6-inch- thick compacted layers to final subgrade.

3.17 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase course and base course to required crown elevations and cross-slope grades.
4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
5. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
6. Compact base course within 3 percent of optimum moisture content to required grades, lines, cross sections, and thickness to an average of 98 percent of maximum dry unit weight with no test below 95 percent of maximum dry unit weight according to AASHTO T180. Average based on 3,000 square yards of tested area.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than an average of 98 percent of maximum dry unit weight with no test below 95 percent of maximum dry unit weight according to AASHTO T180.

3.18 FIELD QUALITY CONTROL

A. Construction Testing: Owner will engage a qualified testing agency to perform the following observations and tests:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material classification and maximum lift thickness comply with requirements.
3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Provide 24 hour notice to testing agency when testing or inspection is needed. However, for Proctor testing (ASTM D698), the testing agency should be provided a minimum of 5 daysto complete the laboratory testing.

C. Allow testing agency to inspect and/or test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: Perform testing to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade, T-bar probing, in-place density testing, or penotrometer testing.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 4000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
2. Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
3. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length but no fewer than two tests.
4. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length but no fewer than two tests.
5. Non-Structural Subgrade: At each compacted backfill layer, at least 1 test for each 6,000 sq. ft or less of non-structural or lawn area.
6. Site retaining wall: At each compacted backfill layer, at least one test for every 100 feet or less of wall length but no fewer than two tests, unless otherwise specified in the wall plans.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.19 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Designer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 20 00

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SECTION 31 23 33 - TRENCHING AND BACKFILLING FOR UTILITY SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. All construction shall conform to the requirements and dimensions on the construction plans, Engineer's Design and Construction Standards and applicable codes of the City. Current specifications of the American Society for Testing Materials (ASTM), the American National Standards Institute (ANSI), and American Water Works Association (AWWA) shall apply in all cases where material is covered by an item in these specifications, and all material used under this contract shall conform fully to these current specifications or be removed from the job at the direction of the Engineer. Failure of the Engineer to condemn materials on preliminary inspection shall not be grounds for acceptance if future defects are found. Should these specifications be in conflict with those of the local authorities, the more stringent shall apply.

B. It shall be the contractor's responsibility to notify local authorities and Engineer at least 24 hours prior to beginning work in order to perform necessary required inspections.

C. The contractor shall conform to all Federal, State and local regulations relating to work, safety, materials, permits, and all other portions of his activities pertaining to this contract.

D. Contractor shall provide and maintain a temporary pedestrian walkway during construction.

E. All excavation work by the Contractor shall be accomplished as "UNCLASSIFIED EXCAVATION".

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This section covers excavation, trenching, backfilling and compaction for utilities systems from a point 5 feet outside the building to the point of connection to other public or private utility.

1.3 RELATED SECTIONS

A. The following sections contain requirements that relate to this Section:

B. Section, 31 22 00 - Earth Moving

C. Section, 33 41 00 - Storm Drainage Utilities

1.4 DEFINITIONS

A. Suitable Soils: Suitable soil materials include soils classified in ASTM D 2487 as GC, SC, SP, GW, and SW.

B. Unsuitable Soils: Unsuitable soil materials shall be soils that do not comply with the requirements for suitable soils. Unsuitable soil materials include, but are not limited to those soils containing roots and other organic matter, trash, debris, frozen materials, and stones larger than 1½ inches, and materials classified in ASTM D 2487, as PT, OH, and OL. Unsuitable soil materials also include man-made fills, refuse, or back fills, from previous construction.

C. Cohesionless and Cohesive Soils: Cohesionless soils include soils classified in ASTM D 2487 as GW, GP, SC, SW, and SP. Cohesive soils include soils classified as GC, SC, ML, CL, MH, and CH. Soils classified as GM and SM will be indentified as cohesionless only when the fines are non-plastic.

D. Unstable Soils: Unstable soils shall consist of soils too wet to properly support the utility pipe, conduit, or appurtenance structure.

E. Select Granular Material: Select granular material shall consist of well graded gravel, crushed gravel, crushed stone, or crushed slab composed of hard, tough, and durable particles, and shall not contain more than 10 percent by weight of material passing a No. 200 mesh sieve and no less than 95 percent by weight passing the 1 inch sieve, with a maximum allowable aggregate size of 1 1/2 inches.

F. Initial Backfill Materials: Initial backfill shall consist of select granular material or suitable soils free from rocks.

G. Degree of Compaction: Plastic marking tape shall be acid and alkali resistant polyethylene film, thickness and width standard with manufacturer. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by meal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion.

H. Tree Protection: All trees and shrubs in construction area shall be protected with tree fencing (refer to plans for specific areas requiring tree protection). No material or earth shall be placed within the drip line of any existing tree. Contractors shall be required to protect all trees and shrubs in construction area.

PART 2 - HANDLING AND STORAGE OF MATERIALS

A. The contractor shall be responsible for the shipping and storage of all materials. Any material that is damaged or defective shall be replaced by the contractor at his own expense.

B. If any material is furnished by the local authority, it shall be the contractor's responsibility to examine such material at the point of delivery and to reject all defective material. If any furnished material is found to be defective after installation and prior to final acceptance, the contractor shall replace the defective material with sound material at his own expense.

C. The loading and unloading of all pipe, manholes and other accessories shall be in accordance with the manufacturer's recommended practices and shall at all times be performed with care to avoid any damage to the material.

D. The contractor shall locate and provide the necessary storage areas for materials and equipment. If private property is being used for storage areas, then the contractor must have the written consent from the Owner. Without this written consent, all material and equipment shall be stored within the existing rights-of-way and easements of the project.

E. All pipes shall be kept free of dirt and other debris. Any damage relating to the coating of the various materials for steam mains shall be repaired in a manner approved by the Engineer.

F. The contractor shall be responsible for safeguarding and protecting all material and equipment stored on the job site. The contractor shall be responsible for the storage of materials in a safe and workmanlike manner to prevent injuries, during and after working hours, until the project is complete.

PART 3 - SAFETY, PROPERTY PROTECTION

A. Signs, barricades, flambeau, warning lights, guards and flagmen shall be employed as necessary when construction endangers either vehicular or pedestrian traffic. These devices shall remain in place until the traffic may proceed normally again. The contractor shall save the Owner and Engineer harmless for any damages or injuries caused under the contract.

B. Detours shall be set up and maintained by the contractor under the direction of the appropriate regulatory agency. Notice must be given a week in advance of the detour so that necessary notification of the traveling public may be made. The contractor will furnish all barricades, signs, lights, and other safety devices to protect his construction. The contractor is in no way relieved of liability for providing this protection because the detour is approved by others.

C. Construction work zone signs and signing procedures shall conform fully to all applicable Federal, State and Local codes. The contractor shall be responsible for securing the necessary permits for all work to be performed in the public rights-of-way.

D. Trees, fences, poles and all other property shall be protected unless their removal is authorized, and any property not authorized for removal, but damaged by the contractor, shall be restored by the Contractor to the Owner's satisfaction.

E. The contractor and any subcontractors shall be responsible for the total compliance to all Federal, State and local ordinances, laws and regulations as it relates to safe construction practices and to protecting the employees and the public's general health.

F. The contractor shall make sure that all Occupational Safety Health Administration (OSHA) regulations and standards are followed during all phases of the construction project.

G. Neither the Engineer nor Owner shall be responsible for making the contractor adhere to the OSHA regulations and standards. However, the Engineer or Owner may report known violations or unsafe practices to the appropriate enforcement agency.

H. Prior to actual construction, the Owner shall acquire the necessary encroachments form NCDOT when working inside the rights-of-way of State system roads or highways.

I. The contractor shall be responsible for securing all other local and State permits required for the utility construction.

PART 4 - EXECUTION

4.1 EXCAVATION

A. General: Excavation of every soil description and of whatever substances encountered shall be performed to the lines and grades indicated. During excavation, material satisfactory for back-filling shall be stockpiled in an orderly manner at a distance from the banks of the trench sufficient to avoid overloading and to prevent slides or cave-ins. Excavated material not required or not satisfactory for back-filling shall be removed from the site. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed so that the authorized over-excavation shall be back-filled in accordance with paragraph BACKFILLING AND COMPACTION at no additional cost to the Owner.

B. Trench Excavation: The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Trench walls below the top of the pipe shall be sloped, or made vertical, and of such width as recommended in the manufacturer’s installation manual. Where no manufacturer’s installation manual is available, trench walls shall be made vertical. Special attention shall be given to slopes that may be adversely affected by weather or moisture content. The trench width below the top of pipe shall not exceed 24 inches plus pipe outside diameter. Where recommended trench widths/depths are exceeded, redesign, stronger pipe, or special installation procedures may be utilized by the Contractor. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to the Owner.

C. Bottom Preparation: The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe.

Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing.

D. Stockpiles: Stockpiles of suitable and unsuitable soils shall be placed and graded as specified. Stockpiles shall be kept in a neat and well-drained condition, given due consideration to drainage at all times. Stockpiles of suitable soils shall be protected from contamination that may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsuitable, such materials shall be removed and replaced with suitable material from approved sources at no additional cost to the Owner. Locations of stockpiles of materials shall be subject to prior approval of the Architect/Owner/Engineer.

4.2 BACKFILLING AND COMPACTION

A. General: Backfill material shall consist of suitable soils, selected granular material or initial backfill material as required. Backfill shall be placed in layers not exceeding six (6) inches loose thickness for compaction by hand operated machine compactors, and eight (8) inches loose thickness for other than hand operated machines, unless otherwise specified. Each layer shall be compacted to at least 96 percent maximum density for cohesionless soils and 90 percent maximum density for cohesive soils, unless otherwise specified.

B. Trench Backfill: Trenches shall be backfilled to the grade shown. The trench shall not be backfilled until visually inspected by Contracting Officer's representative. (The trench shall be backfilled to two (2) feet above the top of pipe prior to performing the required pressure tests. The joints and couplings shall be left uncovered during the pressure test.)

C. Replacement of Unstable Soils: Unstable soils removed from the bottom of the trench or excavation shall be replaced with select material placed in layers not exceeding six (6) inches loose thickness.

D. Bedding and Initial Backfill: (Bedding shall be of the true type and thickness shown.) Initial backfill materials shall be placed and compacted with approved tampers with a height of at least one (1) foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.

E. Final Backfill: The remainder of the trench, except for special materials for pavements shall be backfilled with suitable soils. Backfill material shall be deposited and compacted as follows:

F. Structural Backfill: For trenches and area fills, structural backfill shall be placed and compacted in 8-inch layers to a minimum 95% of Standard Proctor, maximum dry density (ASTM D-698), and increased to 98% for the final sub-base for any pavements, sidewalks, building or structural slabs and footings or as otherwise recommended by a Geo-Technical Engineer.

1. Pavements: Backfill shall be placed up to the elevation at which the pavement requirements control. Water flooding or jetting methods of compaction will not be permitted.
2. Turfed or Seeded Areas and Miscellaneous Areas: Backfill shall be deposited in layers of a maximum of 12-inch loose thickness, and compacted to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. This requirement shall also apply to all other areas not specifically designated above.
3. Special Requirements: Special requirements for both excavation and backfill relating to the specific utilities are as follows:
4. Gas and Water Supply: Trenches shall be of a depth to provide a minimum cover of three (3) feet from the existing ground surface, or from the indicated finished grade, whichever is lower.
5. Gravity Sewer Lines: Sewer lines shall have a minimum depth of cover of 3'-0" below finished grade. Where less than 3'- 0" of cover exists, these sections of pipe shall be ferrous material (DIP).
6. Electrical Distribution: Direct buried cable and conduit or duct line shall have a minimum cover of 24 inches from the finished grade for secondary lines and 36 inches from the finished grade for primary lines, unless otherwise indicated.
7. Plastic Marking Tape: Warning tapes shall be installed directly above the cable, conduit, or pipe at a depth of 12 inches below finished grade unless otherwise shown.
8. Cable Television System: Service cables shall have a minimum cover of 24 inches from the finished grade.

G. Separation of Water and Sewer Lines: A vertical separation of 18 inches between crossing and sewer lines only apples when the water line is over the sewer line. If the water line crosses under the sewer line, both lines shall be constructed of pipes of ferrous materials for a distance of 10 feet on each side of the crossing.

H. Select Granular Material (Bedding Stone): Select Granular Material (#57 Stone) shall be used in all waterline & gravity sewer pipe trenches. Select Granular Material (sand) shall be used for bedding of RCP stormwater drainage pipe trenches. The design intent is to create groundwater drainage wicks to better control subgrade soils drainage.

4.3 ROCK EXCAVATION

A. Rock shall be defined as that solid material that cannot be excavated, in the opinion of the Engineer, by any means other than drilling and blasting, drilling and wedging, or boulders and broken concrete exceeding 1/2 cubic yard in volume. Rock shall be excavated to the same limits as earth excavation except that the trench shall be made six inches lower than the outer bottom of the pipe, and this six inches shall be refilled with six inches of #67 stone and thoroughly compacted to the sub-grade level. No soft or disintegrated rock which in the opinion of the Engineer that can be removed with hand picks or power operated shovels, no previously blasted rock or broken rock, and no rock outside the minimum limits of the trench shall be measured or paid for as rock. All trenches for purpose of rock measurement shall be assumed as having vertical walls. Payment for rock shall not necessarily be made because the contractor blasts the material. In order to assure payment for rock, the overburden must be cleared first, and the rock ascertained

and profiled in lengths as specified by the Engineer. If the contractor drills and blasts before the overburden is taken off, the Engineer, after inspection of the material, decides that the material, decides that the material could have been taken out by power driven shovels, no payment shall be made for rock excavation. All blasting shall be done under the supervision of the Engineer and subject to all applicable regulations. The Engineer reserves the right to require the removal of rock by means other than blasting where any pipe or conduit is either too close or so situated with respect to the blasting as to make blasting hazardous. Rock shall be paid for at the unit price bid per cubic yard for the amount removed measured in place. Rock taken from the ditch shall immediately be hauled away and disposed of by the contractor. No additional compensation shall be made for disposing of the rock. Rock removed shall be paid for as per the accepted bid for the unit price. The contractor shall reimburse the amount for rock not excavated. Otherwise, when rock excavation exceeds the bid quantity, the unit price in the bid shall be paid for the rock in excess.

B. Blasting procedures shall conform to all applicable local, State, and Federal laws and ordinances. A blasting permit shall be obtained from the local authorities. The contractor shall take all necessary precautions to protect life and property, including the use of an approved blasting mat where there exists the danger of throwing rock or overburden. The Contractor shall keep explosive materials that are on the job site in special constructed boxes provided with locks. These boxes shall be painted red and plainly identified as to their contents. Failure to comply with this specification shall be grounds for suspension of blasting operations until full compliance is made. No blasting shall be allowed unless a galvanometer is employed to check cap circuits. Where blasting takes place within five hundred feet of a utility, structure or property which could be damaged by vibration, concussion or falling rock, the contractor shall be required to keep a blasting log for each and every shot. It shall be the contractor's responsibility to have adequate insurance to cover any damages resulting from blasting so to to save the Engineer and Owner harmless from any claims.

PART 5 - TESTING

A. All operations under this Section of the Specifications will be subject to the observation of the Owner's Representative, and of a soils testing laboratory, engaged and paid directly by the Owner except as described herein. The testing laboratory shall be present to inspect quality and determine conformance of materials and workmanship to the requirements of these Specifications during, but not limited to instances as noted in these specifications

B. The laboratory shall be notified at least twenty-four (24) hours in advance when their services are needed for inspection and/or testing.

C. Costs of each initial tests shall be borne by the Owner. Additional testing required due to failure of initial tests to comply with the specifications shall be paid by the Contractor.

D. The laboratory will defer testing of an area until the Contractor states that he has reached the specified compaction on the particular area.

E. Areas for which tests indicate insufficient compaction shall be re-compacted and re-tested until the areas conform to the requirements of the Specifications. Adjustments to moisture content of fill material will be made by aeration or addition of water, whenever necessary to achieve adequate compaction. Cost of aeration, addition of water, and re-compaction shall be borne by Contractor.

PART 6 - SURFACE RESTORATION

A. All disturbed surfaces and property thereon, shall be restored to a condition equal to that existing before construction began, and the contractor shall maintain and be responsible for all ditches in paved streets, curbs, gutters or sidewalks until the contractor re-paves the trench cuts. The contractor, with permission of the inspector, may place temporary or permanent asphaltic material in the cut and be paid under a bid item for the asphaltic material. After installation of pipe the entire construction area shall be graded, seeded and fertilized in accordance with the specifications.

1. Ground cover application rates:
   Lime: 100 lbs/1000 S.F.
   Fertilizer: 10-10-10- - 20 lbs/1000 S.F.
   Seed: Hulled Bermuda - 2 1/2 lbs/1000 S.F.
   Tall Fescue - 6 lb/1000 S.F.
   Phosphate: 18 lbs/1000 S.F. of 20% superphosphate
   Straw: 90 lbs./1000 S.F.

B. The contractor shall be responsible for the proper care of the planted areas during the period when the grass is becoming established. This period shall begin immediately after planting and continue for a period of not less than 90 days and until such time as a good stand of grass is established. Where necessary to obtain a good growth of grass, the contractor shall rework, re-fertilize, and re-sow grass seed on such areas until a satisfactory growth has been obtained.

C. The contractor shall guarantee a good uniform stand of grass shall re-seed any bare or thin spots. The seeded areas shall be kept watered during the construction operations and until an acceptable stand of grass has been obtained. The contractor will be liable under a one-year warranty on materials and workmanship.

PART 7 - GUARANTEE

A. The contractor shall guarantee all material, equipment and workmanship for a period of one year after final acceptance.

END OF SECTION 31 23 33

PART 1 - GENERAL

A. The extent of major erosion and sediment control measures are shown on the Project Plans. The Project General Contractor must adhere to the approved sequence of construction and installation of erosion control measures as detailed and approved by the County Permit. The Contractor shall be responsible for monitoring the effectiveness of erosion control measures, repairing, replacing or modifying the control measures as required to effectively control siltation and erosion, including the protection of public rights-of-way and points of stormwater discharge. DEVIATION from the Erosion Control Plan may be permitted based on review and approval by the Engineer.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary conditions apply to this Section.

B. The North Carolina Sedimentation Pollution Control Act of 1973 (latest edition) shall apply to this Section.

C. The North Carolina Erosion and Sediment Control Planning and Design Manual shall apply to this Section.

D. Permit requirements for General Stormwater NPDES Permit NCG 1,000, as revised October 1, 2001.

1.3 SUMMARY

A. This section includes provisions for the installation and maintenance of erosion and sedimentation control devices.

1.4 DEFINITIONS

A. Temporary Erosion and Sedimentation Control Devices: These measures shall be installed prior to construction and maintained for the duration of construction activities. Following the installation of permanent erosion and sedimentation measures, temporary measures shall be removed. Examples of temporary devices include sediment fence, block and gravel inlet protection, and sediment traps.

B. Permanent Erosion and Sedimentation Control Devices: These measures shall be installed following completion of all construction in any given area. Examples of

1.5 QUALITY ASSURANCE

A. The laws governing erosion and sediment control are performance oriented; therefore, the Contractor shall be prepared to alter erosion control measures that fail to effectively control erosion and sedimentation and provide additional measures as needed and directed by the Owner/Engineer & County.

PART 2 - MATERIALS

A. Permanent Seed: Permanent Seeding shall conform to Section 329200, "TURF".

B. Temporary Seed: Use certified seed inspected by the North Carolina Crop Improvement Association and bearing an official "Certified Seed" label.

December 15 - April 15:	Apply blend of 120#/Ac. Rye (grain) and 50#/Ac. Kobe Lespedeza.
April 15 - August 15:	Apply 40#/Ac. German Millet.
August 15 - December 15:	Apply 120#/Ac. Rye (grain)

C. Lime: Natural dolomitic limestone containing not less than 85 percent of total carbonates with a minimum of 30 percent magnesium carbonates, ground so that not less than 90 percent passes a 10-mesh sieve and not less than 50 percent passes a 100-mesh sieve.

D. Fertilizer: Provide fertilizer with percentage of nitrogen required to provide not less than 1 pound of actual nitrogen per 1,000 square feet of surface area, and not less than 4 percent phosphorus and 2 percent potassium. Provide nitrogen in a form that will be available to grass during initial period of growth. At least 50 percent of nitrogen shall be organic form.

E. Mulch: Provide clean, seed-free salt hay or threshed straw of wheat, rye, oats, or barley at a rate of 70 to 90 pounds per 1000 square feet.

F. Mulch Binder: Asphalt emulsion sprayed at a rate of 10 to 13 gallons per 1000 square feet.

G. Mulch Nettings: Lightweight plastic, cotton, jute, wire, or paper nets with anchoring staples.

H. Riprap: Well-graded mixture of hard, angular stone with 50% by weight larger than the specified size. The diameter of the largest stone size shall be 1.5 times the d50 size with smaller sizes grading down to 1 inch. Classes and specifications of Riprap are as follows:

Class 1: 5 to 200 lbs. gradation with 30% weighing a minimum of 60 lbs. each and no more than 10% weighing less than 15 lbs. each.

Class 2: 25 to 250 lbs. gradation with 60% weighing a minimum of 100 lbs. each and no more than 5% weighing less than 50 lbs. each.

Class A: 2-inch to 6-inch diameter stone sizes with 10% tolerance between top and bottom sizes, equally distributed with no specified gradation.

Class B: 5-inch to 15-inch diameter stone sizes, equally distributed with no specified gradation.

I. Gravel Filter: Well graded gravel or sand gravel layer(s) 6 inches thick of the aggregate gradation specified on the drawings.

J. Filter Blanket: 20 to 60 mils thick with a grab strength of 90 to 120 lbs. conforming to ASTM D 1682 or ASTM D 177 with no less than 4% open area and an equivalent opening size as specified but no less than U.S. Standard Sieve No. 100.

K. Inlet Protection Concrete Masonry Unit: 8-inch by 8-inch by 16-inch nominal size hollow load-bearing concrete blocks conforming to ASTM C 90, Grade N, and net area compressive strength of 1900 psi.

L. Inlet Protection Gravel: #57 washed stone.

M. Sediment Basin Filter: Class B Riprap and #5 washed stone of the quantities and arrangement indicated.

N. Sediment Fence Filter Fabric: Synthetic filter fabric or pervious sheet of polypropylene, nylon, polyester, or polyethylene yarn certified by the manufacturer as conforming to the following minimum requirements: 85% filtering efficiency, 30 lbs./in in tensile strength at 20% elongation, and 0.3 gals/sq. ft./min. slurry flow rate.

O. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0 to 120 degrees F.

P. Sediment Fence Post: 1.33 lb./L.F. steel with a minimum length of 4 feet with projections to fasten filter fabric.

Q. Sediment Fence Wire Mesh: 14 gauge wire with maximum spacing of 6 inches.

R. Stabilization Gravel: 6-inch thick course of Aggregate Base Course as specified in NCDOT "Standard Specifications for Roads and Structures".

S. Dust Control Materials: Acceptable materials for controlling dust are as follows:
1. Vegetative Cover: Temporary or Permanent Seeding as specified herein.
2. Mulch: Straw or gravel coverings as specified herein.
3. Spray-on Adhesive: Types and rates are as follows.
4. Anionic Asphalt Emulsion: 7:1 water dilution applied at 1200 gallons per acre with a coarse spray nozzle.
5. Latex Emulsion: 12.5:1 water dilution applied at 235 gallons per acre with a fine spray nozzle.
6. Resin in Water: 4:1 water dilution applied at 300 gallons per acre with a fine spray nozzle.

PART 3 - EXECUTION

A. Surface Roughening: Roughen areas to shallow grooves by normal tilling, disking, harrowing, or use of cultipacker-seeder. Make the final pass of any such tillage implement on the contour. Make grooves formed by such implements less than 10-inches apart and not less than 1-inch deep.

B. Limit roughening with tracked machinery to sandy soils to avoid undue compaction of the soil surface. Operate machinery up and down the slope to leave horizontal depressions in the soil. Do not back-blade during the final grading operation.

C. Temporary Gravel Construction Entrance/Exit: Remove vegetation, roots, and other unacceptable materials and properly grade the construction entrance/exit area. Place the gravel to the depths and dimensions indicated on the plans and smooth the surface. Use geotextile fabric in locations subject to seepage or high water table.

D. Temporary/ Permanent Seeding: Prepare seedbed to a well-pulverized, loose, and uniform surface. Apply lime and fertilizer to the soil and mix to a depth of 4 to 6 inches. Apply seed evenly to soil using a broadcast seeder, drill, culti-packer seeder, or hydro-seeder at the rates specified. Broadcast seed shall be covered by raking, or chain dragging and then lightly firmed with a roller or culti-packer. Small grain seeds should be planted no more than 1-inch deep, grasses and legumes no more than 1/2-inch deep. All areas shall be mulched following seeding.

E. Permanent Seeding: See Section 312500, Part 3, D.

F. Mulching: Apply mulching following seeding of exposed areas except under the following methods:
   1. Seed is combined with a hydroseeder slurry containing wood fiber mulch.
   2. A hydroseeder slurry is applied over straw.

G. Application of Organic Mulch: Spread mulch uniformly, by hand, or with a mulch blower. When hand spreading, divide the area into sections of 1000 sq. ft. to facilitate uniform distribution. No more than 25% of the ground surface shall be visible following mulching.

H. Anchoring Organic Mulch: Immediately anchor straw mulch following spreading by one of the following methods:
   1. Mulch Anchoring Tool: Operate the machinery on the contour.
   2. Liquid Mulch Binder: Apply uniformly except at edges of areas and at ridges or crests where a heavier application is required to prevent displacement due to wind. Binder may be applied together with the mulch material.
   3. Mulch Nettings: Apply over the mulch. Start laying the netting from the top of channels and slopes and proceed downhill. Allow netting to lay loosely but without wrinkles - do not stretch. To secure the net, bury the uphill end in a slot or trench to a depth of 6 inches. Staple the net every 12 inches across the top end and every 3 feet along the edges, along the bottom end and down the center. Edges of netting shall be overlapped a distance of 3 inches

and stapled together. Do not stretch the net when applying staples. To join ends of netting, bury the downhill netting in a 6-inch deep slot or trench and overlap the uphill netting a distance of 18 inches. Staple the nettings together every 12 inches just below the slot or trench.

I. Riprap Placement: Prepare the subgrade by removing all vegetation and other unacceptable materials and cutting to a depth that allows placement of the Riprap at the finished grade of the surrounding area. Place the gravel filter or filter blanket upon the prepared subgrade as follows:

1. Gravel Filter: Spread gravel in a uniform layer to the depth specified. Where more than one layer is required, minimize mixing of the layers.

2. Riprap: Placement of the Riprap shall proceed following installation of the filter. A dense, well-graded mass of stones with a minimum of voids shall be formed. Place Riprap to it's full thickness in one operation. Do not place by dumping through chutes or in other ways that cause segregation of stone sizes. Take care not to dislodge the filter material. The finished slope should be free of pockets of small stone or clusters of large stone. Hand placing may be necessary to achieve the proper distribution of stone sizes. The finished surface of the Riprap shall blend with the surrounding grade. No overfall or protrusion shall be apparent.

J. Temporary Diversions: Remove vegetation, roots, and other unacceptable materials and grade to the cross section shown on the plans. Provide sufficient room around diversion to permit machine regrading and cleanout. Immediately vegetate the ridge of the dike after construction if diversion will remain beyond 30 working days.

K. Grass-lined Channel: Remove vegetation, roots, and other unacceptable materials and excavate and shape channel to dimensions and grades shown on the plans. Grade a 0.2-ft overcut around the channel perimeter to allow for bulking during seedbed preparation. Remove and dispose of all excess soil so that surface water may enter the channel freely. Protect the channel with a mulch or temporary liner to control erosion during the grass establishment period.

L. Riprap Apron: Remove vegetation, roots, and other unacceptable materials and excavate and shape area to dimensions and grade of the soil foundation shown on the plans. Prepare subgrade and place filter blanket and Riprap as specified herein under "Riprap Placement". The minimum thickness of the Riprap shall be 1.5 times the maximum stone diameter. Construct the apron on zero grade with no over fall at the end. Install the top of the Riprap at the downstream end level with the receiving area or slightly below it. Ensure that the apron is properly aligned with the pipe and straight throughout its length. After construction, immediately vegetate all disturbed areas.

M. Block and Gravel Inlet Protection: Excavate the soil around the inlet 2 inches below the top of the inlet and place the bottom row of concrete blocks against the inlet to provide lateral support. Lay concrete blocks in bottom row on sides too allow for drainage through the structure. Place second row of concrete block on top of bottom row. Install wire mesh with 1/2-inch openings over all block openings to

prevent gravel from passing through block openings. Place gravel against wire to a height of 2-inches below top of concrete blocks as depicted on the plans.

N. Temporary Sediment Trap: Remove vegetation, roots, and other unacceptable materials from sediment trap area. Ensure that fill material for the embankment is free of organic or other objectionable materials. Place fill in lifts not to exceed 9 inches and machine compact. Over fill the embankment 6 inches to allow for settlement. Clear the sediment pit below the elevation of the crest of the spillway to facilitate sediment cleanout. Construct the spillway section as shown on the plans. Place a filter blanket between the Riprap and soil. Extend the blanket across the spillway foundation and sides to the top of the dam. Construct the spillway so that the bottom of the stone filter is a minimum of 3 feet. Place the stone filter and work the smaller stones into the voids of the larger stones. Install the weir at a minimum of 3 feet from the bottom of the sediment pit and level to ensure design capacity. Ensure that the stone extends downstream past the toe of the embankment until stable conditions are reached. Keep the edges of the stone outlet flush with surrounding grade and shape the center to confine the outlet flow. Stabilize the embankment and all disturbed areas above the sediment pool and downstream from the outlet immediately following construction. Mark the distance from the top of the spillway to the sediment cleanout level in the field.

O. Sediment Fence: Construct sediment fence no more than 18 inches above grade. Install posts at a minimum depth of 18 inches below grade. Excavate a trench 4 inches wide by 8 inches deep along the upslope side of the post line. Fasten mesh to posts using heavy duty staples at least 1-inch long or tie wires and extend to bottom of trench. Attach filter fabric to wire mesh and extend to bottom of trench. Work from a continuous roll to avoid joints. When joints are necessary, secure filter fabric at support post and install next piece at previous post to provide overlap. Backfill the trench with compacted soil or gravel placed over the mesh and filter fabric.

P. Construction Road Stabilization: Clear road bed of vegetation, roots, and other unacceptable materials. Road construction should follow along contour if possible. Locate parking and storage areas on the flatter areas of the site if possible and maintain positive drainage. Divert excess runoff to stable areas by way of temporary diversions as specified herein. Keep cuts and fills at 2:1 or flatter. Spread a 6-inch course of "ABC" crushed stone evenly over the full width of the roadbed and smooth. Employ geotextile fabric or subsurface drains in areas where seepage or seasonal wetness is encountered. Vegetate all roadside ditches, cuts, fills, and other disturbed areas remaining in place for a period of 30 or more working days.

Q. Check Dam: Place filter fabric and stone to the lines and dimensions shown on the plans. Keep the center stone section 9 inches below grade at the top of the channel banks. Extend stone at least 18 inches beyond the top of the channel banks to keep overflow water from undercutting the dam as it re-enters the channel. Set spacing between dams such that the top of the lower dam and toe of the upper dam are at the same elevation. Protect the channel downstream from the lowest dam with a Riprap apron as specified herein. Ensure that the channel reach above the uppermost dam is stable. Ensure that culverts interfacing with the channel are not blocked by the check dams or displace stones.

R. Dust Control: Apply dust control methods as follows:
   1. Vegetative Cover: Install as specified herein under "Temporary Seeding" or "Permanent Seeding".
   2. Mulch: Place as specified herein under "Mulching".
   3. Spray-on Adhesives: Apply by sprayer at the rates and with the type nozzle specified herein under "Materials" section.
   4. Calcium Chloride: Apply with mechanical spreader at a rate that keeps the surface moist but below levels that cause water pollution and/or plant damage.
   5. Water: Sprinkle the site until surface is wet.
   6. Stabilization Stone: Place as specified herein under "Construction Road Stabilization".
   7. Sediment Fence: Install to control wind as specified herein under "Sediment Fence".
   8. Tillage: Deep plow large open disturbed areas to bring clods of soil to the surface. Begin plowing on the windward side of the site.

3.2 MAINTENANCE

A. General: The Contractor shall be responsible for maintenance of all temporary erosion and sediment control measures during construction operations and until installation of permanent control measures.

B. Erosion and Sediment Control measures shall be installed and maintained to sufficiently retain sediment within the boundaries of the site. All surfaces shall be non-erosive and stable within 30 working days or 120 calendar days after completion of the construction activities, whichever period is shorter.

C. Temporary Gravel Construction Entrance/Exit: Maintain the gravel pad in a condition to prevent mud or sediment from leaving the site. This may require topdressing with 2-inch stone.

D. Temporary Seeding: Re-seed and mulch areas where seedling emergence is poor or where erosion occurs. Do not mow. Protect from traffic as much as possible.

E. Permanent Seeding: See Section 329200.

F. Mulching: Inspect all mulches periodically and after rainstorms to check for rill erosion, displacement, or failure. Where erosion occurs, apply additional mulch. If washout occurs, repair the grade, re-seed in seeded areas, and reinstall mulch.

G. Riprap: Inspect periodically for scour or dislodged stones.

H. Temporary Diversions: Inspect once a week and after every rainfall. Remove sediment from the flow area and repair the diversion ridge.

I. Grass-lined Channels: During the establishment period, check grass-lined channels after every rainfall. Make repairs to eroded soils. Check the channel outlet for bank stability and evidence of scouring.

J. Remove all significant sediment accumulation. After grass emerges, routinely inspect and nurture the grass until a healthy and vigorous stand is established to provide optimum erosion control.

K. Block and Gravel Inlet Protection: Inspect after each rainfall and remove sediment to provide adequate storage volume for subsequent rainfall event.

L. Temporary Sediment Trap: Inspect after significant rainfall. When sediment has accumulated to one-half the depth of the trap, remove the sediment and restore trap to its original lines and dimensions. Replace contaminated parts of the spillway's gravel facing. Periodically check to ensure the top of the spillway is 1.5 feet below the top of the embankment. Fill any settlement of the embankment back to its specified height. Replace dislodged Riprap from the spillway.

M. Sediment Fence: Inspect once a week and after each rainfall and replace damaged, collapsed, or disconnected fabric. Remove significant sediment accumulations. Take care to keep from undermining the fence during cleanout.

N. Construction Road Stabilization: Inspect construction roads and parking areas periodically and top-dress with new gravel as needed. Check road ditches after significant rainfall for erosion and deposits of sediment. Repair and remove sediment as needed to ensure effective drainage.

O. Check Dam: Inspect after each rainfall event and check for scouring along edges of the dam. Repair damages and remove significant accumulations of sediment behind the check dam. If substantial erosion occurs between dams, install a Riprap liner in that portion of the channel as specified herein under "Riprap Channel". Replace dislodged stones and add stone as needed to maintain specified height of check dam.

P. Clean and Repair Storm Drainage System: Maintain inlet protection at all storm drain entrances. If pipes become silted, remove silt or replace pipe prior to removal of temporary sedimentation control facilities. Pipes and structures, including Riprap channels and aprons, shall be free of mud, silt and debris prior to inspection by Engineer and acceptance by Owner.

END OF SECTION 31 25 00

PART 1 - EXCAVATION SUPPORT AND PROTECTION

1.1 GENERAL

A. Related Documents

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

1.2 SUMMARY

A. Section includes temporary excavation support and protection systems.

B. Related Sections:

1.3 PERFORMANCE REQUIREMENTS

A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.

1. Retain option in paragraph above and retain first subparagraph below if Contractor is required to assume responsibility for design. If necessary, revise subparagraph to meet requirements of authorities having jurisdiction or to follow customary practice in Project's location.

2. Delegated Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

3. Prevent surface water from entering excavations by grading, dikes, or other means.

4. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.

5. Monitor vibrations, settlements, and movements.

1.4 SUBMITTALS

A. Shop Drawings: For excavation support and protection system.

B. Delegated-Design Submittal: For excavation support and protection system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Other Informational Submittals:

1. Photographs or Videotape: Show existing conditions of adjacent construction and sie improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems. Submit before Work begins.

2. Record Drawings: Identifying and locating capped utilities and other subsurface structural, electrical, or mechanical conditions.

1.5 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to excavation support and protection system including, but not limited to, the following:

a. Geotechnical report.

b. Existing utilities and subsurface conditions.

c. Proposed excavations.

d. Proposed equipment.

e. Monitoring of excavation support and protection system.

f. Working area location and stability.

g. Coordination with waterproofing.

h. Abandonment or removal of excavation support and protection system.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Owner or Owner's Representative no fewer than two days in advance of proposed interruption of utility.

2. Do not proceed with interruption of utility without Owner's or Owner Representative's written permission.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.

1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.

2. The geotechnical report is referenced elsewhere in the Project Manual.

C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and

positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that are either new or in serviceable condition.

B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.

D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.

E. Shotcrete: Comply with Division 03 Section "Shotcrete" for shotcrete materials and mixes, reinforcement, and shotcrete application.

F. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

G. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

H. Tiebacks: Steel bars, ASTM A 722/A 722M.

I. Tiebacks: Steel strand, ASTM A 416/A 416M.

PART 3 - EXECUTION

A. PREPARATION

B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.

C. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

D. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces are not impeded.

E. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, break-

age, or other evidence of movement to ensure that excavation support and protection systems remain stable.

F. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.2 SOLDIER PILES AND LAGGING

A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

3.3 SHEET PILING

A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

3.4 TIEBACKS

A. Tiebacks: Drill, install, grout, and tension tiebacks. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.

1. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system.

2. Maintain tiebacks in place until permanent construction is able to withstand lateral soil and hydrostatic pressures.

3.5 BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.

2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.

3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.

1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlaying construction and abandon remainder.

2. Fill voids immediately with approved backfill compacted to density specified in Division 31 Section "Earth Moving."

3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

B. Leave excavation support and protection systems permanently in place.

END OF SECTION 31 50 00

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SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Cold milling of existing hot-mix asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Hot-mix asphalt paving overlay.
5. Asphalt surface treatments.
6. Pavement-marking paint.

B. Related Sections:
1. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
2. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.
3. Division 32 Section “Pavement Markings” for pavement paint.

1.3 DEFINITION

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Material Certificates: For each paving material, from manufacturer.

D. Material Test Reports: For each paving material.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by NCDOT.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of NCDOT for asphalt paving work.
   1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
   1. Prime Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
   2. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
   3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
   4. Asphalt Base Course: Minimum surface temperature of 40 deg F (4.4 deg C) and rising at time of placement.
   5. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces at temperatures noted in Section 32 17 23.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320 or AASHTO MP 1a, PG 64-22.

B. Asphalt Cement: ASTM D 3381 for viscosity-graded material.

C. Prime Coat: Asphalt emulsion prime coat complying with NCDOT requirements.

D. Water: Potable.

E. Undersealing Asphalt: ASTM D 3141, pumping consistency.

2.3 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

B. Joint Sealant: ASTM D 6690, hot-applied, single-component, polymer-modified bituminous sealant.

C. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N; colors complying with FS TT-P-1952.
1. Color: As indicated.

D. Wheel Stops: Precast, air-entrained concrete, 2500-psi (17.2-MPa) minimum compressive strength,. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.
1. Dowels: Galvanized steel, 3/4-inch (19-mm) diameter, 10-inch (254-mm) minimum length.

2.4 MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with NCDOT'S requirements

PART 3 - PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).

3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

D. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

3.2 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.
1. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.
1. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch (6 mm).
1. Clean cracks and joints in existing hot-mix asphalt pavement.

2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.

3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.

3.4 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure.
1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at minimum temperature of 250 deg F (121 deg C).
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.
   1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
B. Clean contact surfaces and apply tack coat to joints.
C. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
D. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
E. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
F. Compact asphalt at joints to a density within 2 percent of specified course density.

3.7 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
   1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
   1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927, but not less than 94 percent nor greater than 100 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
1. Base Course: Plus or minus 1/2 inch (13 mm).
2. Surface Course: Plus 1/4 inch (6 mm), no minus.

3.9 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer and Owner.

B. Allow paving to age for 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

3.10 WHEEL STOPS

A. Install wheel stops in bed of adhesive as recommended by manufacturer.

B. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.
1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.

2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
   a. One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than 3 cores taken.
   b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.12 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
   1. Do not allow milled materials to accumulate on-site.

END OF SECTION 32 12 16

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Exterior concrete paving for the following:
1. Driveways.
2. Roadways.
3. Parking lots.
4. Curbs and gutters.
5. Walks.

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B. Related Requirements:
1. Section 321220 “Aggregates” for aggregate base course and surface course.
2. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
3. Section 321723 "Pavement Markings."

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to concrete paving, including but not limited to, the following:
a. Concrete mixture design.
b. Quality control of concrete materials and concrete paving construction practices.
c. Installation of concrete base for ramps and walks. Review slope requirements prior to installation.
2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.

c. Ready-mix concrete manufacturer.

d. Concrete paving Subcontractor.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

C. Samples for Verification: For each type of product or exposed finish, prepared as Samples of size indicated below:
1. Colored Concrete: Provide manufacturer's standard sample size.

D. Design Mixtures: For each concrete paving mixture. Comply with NCDOT Standard Specification, Section 1000. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer of ready-mix concrete manufacturer, and testing agency.

B. Material Certificates: For the following, from manufacturer:
1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

C. Material Test Reports: Provide test results from a qualified testing agency indicating and interpreting test results for compliance of the following per NCDOT Standard Specification, Sections 700, 710, and 1000:
1. Thickness tolerances.
2. Surface finish tolerance (modified.)
3. Air Content.
4. Slump.
5. Flexural strength.
6. Compression Test.

D. Report test results in writing to Designer, within 48 hours of testing. Reports of compressive-strength tests must contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for 7-day and 28-day tests.

E. Provide all field quality-control reports and testing.

1.7 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Notify Designer 7 days in advance of mockup installation.
   2. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
   3. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Designer and not less than 96 inches by 96 inches.
   4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Designer specifically approves such deviations in writing.
   5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

1.9 REGULATORY REQUIREMENTS

A. Regulatory Requirements: Unless otherwise indicated, comply with materials, workmanship, and other applicable requirements of North Carolina Department of Transportation Standard Specifications for Roads and Structures and ACI "Specification for Concrete" for concrete paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.
2. NCDOT Specifications: North Carolina Department of Transportation Standard Specifications for Roads and Structures.
3. Any reference to "NCDOT", "Department" or "Unit" within the NCDOT Specifications applies to the "Owner".

B. Quality Control for Asphalt Pavements: Comply with Section 609 of the NCDOT Specifications, except as indicated below:
1. Testing Frequencies of Core Samples:
   a. Conduct density sampling based on test sections consisting of not more than 1000 square yards or fraction thereof per day on pavement placed. This is a modification to NCDOT Standard Specifications.
   b. Conduct sampling and testing as specified in NCDOT Standard Specifications based on test sections consisting of not more than 1000 square yards or fraction thereof per day on pavement placed at the paver laydown width. This is a modification to NCDOT Standard Specifications.
   c. Contractor may elect to use either cored sample density procedures or density gauge procedures.

C. The placing of asphalt concrete surface paving to comply with NCDOT Specifications Seasonal and Weather Restrictions, unless otherwise approved by the Designer.

1.10 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with NCDOT Standard Specifications, Section 700-5, and the following:
1. Do not pave when a descending air temperature reaches 35°F. Do not resume until the temperature is 35°F and rising.
2. Do not place concrete over frozen subgrade or base course or aggregate.
3. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F and not more than 80°F at point of placement.
4. Do not use frozen materials or materials containing ice or snow.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature,

provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Steel Reinforcements: Comply NCDOT Standard Specifications, Section 1070.

2.4 CONCRETE MATERIALS

A. Portland Cement Concrete for Paving: Comply with NCDOT Standard Specifications, Section 700.

B. Normal-Weight Aggregates: Comply with NCDOT Standard Specifications, Section 1014.

2.5 Insert requirement for recycled content of coarse aggregate if required for LEED Credit MR 4. Verify availability before specifying.

2.6 Retain one option in "Maximum Coarse-Aggregate Size" Subparagraph below; insert gradation requirements if preferred. PCA recommends maximum aggregate size of 3/4 inch (19 mm) in base slab if seeded exposed aggregate is paving finish.

2.7 Retain "Fine Aggregate" Subparagraph below to prohibit the exception in ASTM C 33/C 33M that allows using reactive fine aggregate if low-alkali cement or reaction-inhibiting admixture is also required.

2.8 Retain "Exposed Aggregate" Paragraph below if seeded or monolithic exposed-aggregate paving finish is required.

A. Air-Entraining Admixture: Comply with NCDOT Standard Specifications, Section 1000.

B. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

C. Water-Reducing Admixture: Comply with NCDOT Standard Specifications, Section 1000.

D. Retarding Admixture: Comply with NCDOT Standard Specifications, Section 1000;

E. Water-Reducing and Retarding Admixture: Comply with NCDOT Standard Specifications, Section 1000.

F. High-Range, Water-Reducing Admixture: Comply with NCDOT Standard Specifications, Section 1000.

G. High-Range, Water-Reducing and Retarding Admixture: Comply with NCDOT Standard Specifications, Section 1000.

H. Plasticizing and Retarding Admixture: Comply with NCDOT Standard Specifications, Section 1000.

I. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

J. Color: As selected by Designer from manufacturer's full range.

K. Water: Potable and complying with ASTM C 94/C 94M.

2.9 CURING MATERIALS

A. Concrete Curing Agents: Free of impurities and complying with NCDOT Standard Specifications, Section 1026.

B. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Corporation-Construction Systems; MasterKure ER 50 (Pre-2014: Confilm.
      b. Bon Tool Co.; 32-301-B7 BonWay Evaporation Retarder.
      c. Brickform; a division of Solomon Colors; Evaporation Retarder.

d. ChemMasters, Inc; Spray-Film.

e. Dayton Superior; AquaFilm Concentrate J74.

f. Euclid Chemical Company (The); an RPM company; Eucobar.

g. Kaufman Products, Inc; VaporAid.

h. L&M Construction Chemicals, Inc; E-CON.

i. Lambert Corporation; LAMBCO Skin.

j. Metalcrete Industries; Waterhold.

k. Nox-Crete Products Group; MONOFILM.

l. Sika Corporation; SikaFilm.

m. SpecChem, LLC; SpecFilm.

n. TK Products; TK-2120 TRI-FILM.

o. Vexcon Chemicals Inc.; Certi-Vex EnvioAssist.

p. W.R. Meadows, Inc; EVAPRE.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Anti-Hydro International, Inc; A-H Curing Compound #2 DR WB.

b. ChemMasters, Inc; Safe-Cure Clear DR.

c. Dayton Superior; Clear Resin Cure J11W.

d. Euclid Chemical Company (The); an RPM company; Kurez DR VOX or Kurez W VOX.

e. Kaufman Products, Inc; DR Cure.

f. L&M Construction Chemicals, Inc; L&M CURE R.

g. Lambert Corporation; AQUA KURE - CLEAR.

h. Nox-Crete Products Group; Res-Cure DH or Res-Cure DS.

i. Right Pointe; Clear Water Resin.

j. SpecChem, LLC; PaveCure Rez.

k. TK Products; TK-2519 DC WB.

l. Unitex by Dayton Superior; Hydroseal 18.

m. Vexcon Chemicals Inc.; Certi-Vex Enviocure 100.

n. W.R. Meadows, Inc; 1100-CLEAR SERIES.

G. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Anti-Hydro International, Inc; A-H Curing Compound #2 WP WB.

b. ChemMasters, Inc; Safe-Cure 2000.

c. Dayton Superior; White Resin Cure J10W.

d. Euclid Chemical Company (The); an RPM company; Kurez VOX White Pigmented.

e. Kaufman Products, Inc; Thinfilm 450.

f. L&M Construction Chemicals, Inc; L&M CURE R-2.

g. Lambert Corporation; AQUA KURE - WHITE.

h. SpecChem, LLC; PaveCure Rez White.

i. Vexcon Chemicals Inc.; Certi-Vex Enviocure White 100.

j. W.R. Meadows, Inc; 1100-WHITE SERIES or 1200-White.

2.10 RELATED MATERIALS

A. Joint Fillers: Comply with NCDOT Standard Specifications, Section 1028-1; ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

2.11 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete to comply with ACI 301.

C. Portland Cement Concrete: Comply with NCDOT Standard Specifications, Section 1000.
1. Concrete paving mix design must comply to the following requirements in addition to NCDOT Standard Specifications;
a. Roadways, bus lanes, airfield pavement slabs, and dumpster pads:
1) Flexural strength of 650 psi at 28 days.
b. Walkways and curb and gutter:
1) Compressive strength of 4,000 psi at 28 days.
c. Unit paver base:
1) Compressive strength of 3,000 psi at 38 days

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete and concrete materials to comply with NCDOT Standard Specifications, Section 1000.
1. Place concrete per NCDOT Standard Specifications, Sections 700, 710, and 1000.
a. Elapsed Time for Placing Concrete: NCDOT Standard Specifications, Section 1000-4(E).

TABLE 1000-2 (ELAPSED TIME FOR PLACING CONCRETE)		
AIR OR CONCRETE TEMP (WHICHEVER IS HIGHER	MAXIMUM ELAPSED TIME. NO RETARDING ADMIXTURE ADMIXTURE USED	RETARDING
90F OR ABOVE	30 MIN	1 HR. 15 MIN
80F – 89F	45 MIN	1 HR. 30 MIN
79F OR BELOW	60 MIN	1 HR. 25 MIN

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Provide compaction per Drawings and as specified below.

C. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.
1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.

2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.

3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

D. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT INSTALLATION

A. Install steel reinforcement to comply with NCDOT Standard Specifications.

B. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

C. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

D. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

A. Install joints to comply with NCDOT Standard Specifications, Section 700-11.

B. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

C. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

PART 4 - RETAIN FIRST TWO SUBPARAGRAPHS BELOW IF STEEL REINFORCEMENT IS REQUIRED; REVISE TO SUIT PROJECT.

A. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.

B. Provide tie bars at sides of paving strips where indicated.

PART 5 - RETAIN ONE OR MORE "BUTT JOINTS," "KEYED JOINTS," AND "DOWELED JOINTS" SUBPARAGRAPHS BELOW. CONSIDER BUTT JOINTS FOR JOINTS NOT SUBJECT TO TRAFFIC.

A. Butt Joints: Use bonding agent or epoxy-bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

PART 6 - RETAIN "KEYED JOINTS" SUBPARAGRAPH BELOW FOR LOW-TRAFFIC AREAS IF APPLICABLE. KEYED JOINTS ARE INCAPABLE OF SIGNIFICANT LOAD TRANSFER AT JOINT AND ARE NOT RECOMMENDED BY ACI 302.1R FOR CONCRETE LESS THAN 6 INCHES (150 MM) THICK.

A. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

PART 7 - RETAIN "DOWELED JOINTS" SUBPARAGRAPH BELOW FOR LOAD-TRANSFER DOWELED JOINTS. REVISE IF PRECOATED DOWELS ARE REQUIRED.

A. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

B. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

PART 8 - EXPANSION JOINTS ARE TYPES OF ISOLATION JOINTS. REVISE SPACING IN FIRST SUBPARAGRAPH BELOW TO SUIT PROJECT OR DELETE IF NOT REQUIRED.

A. Locate expansion joints at intervals of 50 feet unless otherwise indicated.

B. Extend joint fillers full width and depth of joint.

C. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.

D. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.

E. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

F. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

G. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

    a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

    a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.

3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

H. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

8.2 CONCRETE PLACEMENT

A. Do not place additional pavement, aggregate, or soil next to newly placed concrete until the concrete has attained a compressive strength of at least 3,500 psi.

B. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

C. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

D. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

E. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

F. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

H. Uniformly vibrate the concrete after it has been spread. Consolidate the full width and depth in a single pass.

I. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
   1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

J. Screed paving surface with a straightedge and strike off.

K. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

L. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

M. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
   1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

8.3 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
   1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
   2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
   3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

8.4 SPECIAL FINISHES

A. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in paving surface as follows:
   1. Immediately after float finishing, spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
   2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
   3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
   4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.

B. Seeded Exposed-Aggregate Finish: Immediately after initial floating, spread a single layer of aggregate uniformly on paving surface. Tamp aggregate into plastic concrete and float finish to entirely embed aggregate with mortar cover of 1/16 inch.
   1. Spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
   2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove sheeting when ready to continue finishing operations.
   3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
   4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.

C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions and as follows:
   1. Uniformly spread dampened, slip-resistive aggregate over paving surface in two applications at manufacturer’s recommended rate to achieve required slip-resistance. Tamp aggregate flush with surface using a steel trowel, but do not force below surface.
   2. Uniformly distribute approximately two-thirds of slip-resistive aggregate over paving surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second slip-resistive aggregate application, uniformly distributing remainder of material at right angles to first application to ensure uniform coverage, and embed by power floating.
   3. Coordinate curing compounds retained in Part 2 for compatibility with slip-resistive aggregate and, if required, revise lists of manufacturers accordingly. Special curing compounds may be required.
   4. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.

5. After curing, lightly work surface with a steel-wire brush or abrasive stone and water to expose nonslip aggregate.

D. Rock-Salt Finish: After initial floating, troweling, or brooming, uniformly spread rock salt over paving surface at the rate of 5 lb/100 sq. ft.
   1. Embed rock salt into plastic concrete with roller or magnesium float.
   2. Cover paving surface with 1-mil- thick polyethylene sheet and remove sheet when concrete has hardened and seven-day curing period has elapsed.
   3. After seven-day curing period, saturate concrete with water and broom-sweep surface to dissolve remaining rock salt, thereby leaving pits and holes.

E. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surface according to manufacturer's written instructions and as follows:
   1. Uniformly spread dry-shake hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer to match paving color required.
   2. Uniformly distribute approximately two-thirds of dry-shake hardener over the concrete surface with mechanical spreader; allow hardener to absorb moisture and embed it by power floating. Follow power floating with a second application of pigmented mineral dry-shake hardener, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed hardener by final power floating.
   3. After final power floating, apply a hand-troweled finish followed by a broom finish.
   4. Cure concrete with curing compound recommended by dry-shake hardener manufacturer. Apply curing compound immediately after final finishing.

8.5 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with NCDOT Standard Specifications, Sections 700 and 710.

C. Comply with ACI 306.1 for cold-weather protection.

D. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

E. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

F. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.

b. Continuous water-fog spray.

c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

8.6 PAVING TOLERANCES

A. Comply with tolerances in NCDOT Standard Specifications and as follows:

1. Elevation: 1/4 inch.

2. Thickness: Plus 3/8 inch, minus 1/4 inch.

3. Surface: Gap below 10-feet- long; unleveled straightedge not to exceed 1/4 inch.

4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.

5. Lateral Alignment and Spacing of Dowels: 1 inch.

6. Vertical Alignment of Dowels: 1/4 inch.

7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.

8. Joint Spacing: 3 inches.

9. Contraction Joint Depth: Plus 1/4 inch, no minus.

10. Joint Width: Plus 1/8 inch, no minus.

8.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to NCDOT Standard Specifications, Sections 700, 710, and 1000 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 400 cu. yd. or fraction thereof of each concrete mixture placed each day.

a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: Pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: One test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: Cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: Test one specimen at seven days and two specimens at 28 days.
    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
7. Flexural Strength Test: NCDOT Standard Specifications, Section 700-15. Provide one beam taken every 400 cubic yards for 28-day strength test for each mix identified with a flexural strength rating.
8. Thickness Tolerances: NCDOT Standard Specifications, Section 700-15 and Sections 710-9. Provide one core every 1000 cubic yards, or distinct project area.
9. Surface Tolerance: Finish surface must be within 1/4-inch when checked longitudinally with a 10-foot straight edge.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Designer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Designer but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Designer.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

I. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

J. Prepare test and inspection reports.

8.8 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Designer.

B. Drill test cores, where directed by Designer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

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. Adjust list below to suit Project.
   2. Expansion and contraction joints within cement concrete pavement for vehicle use.
   3. Joints between cement concrete and asphalt pavement.

B. Related Sections include the following:
   1. Division 07 Section "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.
   2. Division 32 Section "Asphalt Paving" for constructing joints between concrete and asphalt pavement.
   3. Division 32 Section "Concrete Paving" for constructing joints in concrete pavement.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. Qualification Data: For Installer.

E. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
   1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
   1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
   3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
   5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products within a 36-month period preceding the Notice to Proceed with the Work.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
   2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (4.4 deg C).
   3. When joint substrates are wet or covered with frost.
   4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

B. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

2.3 COLD-APPLIED JOINT SEALANTS

A. Multicomponent Jet-Fuel-Resistant Sealant for Concrete: Pourable, chemically curing elastomeric formulation complying with the following requirements for formulation and with ASTM C 920 for type, grade, class, and uses indicated:
   1. Urethane Formulation: Type M; Grade P; Class 12-1/2; Uses T, M, and, as applicable to joint substrates indicated, O.
      a. Products:
         1) Pecora Corporation; Urexpan NR-300.
   2. Coal-Tar-Modified Polymer Formulation: Type M; Grade P; Class 25; Uses T and, as applicable to joint substrates indicated, O.
      a. Products:
         1) Meadows, W. R., Inc.; Sealtight Gardox.

B. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.
   1. Products:
      a. Crafco Inc.; RoadSaver Silicone.
      b. Dow Corning Corporation; 888.

2.4 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.5 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of backer materials.
   2. Do not stretch, twist, puncture, or tear backer materials.
   3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses provided for each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 321373

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes thermoplastic pavement markings applied to asphalt pavement.

B. Related Requirements:
1. Section 012200 "Unit Prices" for pavement marking unit prices.
2. Section 321216 "Asphalt Paving."

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to marking pavement including, but not limited to, the following:
a. Pavement aging period before application of pavement markings.
b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include technical data and tested physical and performance properties.

B. Shop Drawings: For pavement markings.
1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples: For each exposed product and for each color and texture specified; on rigid backing, 8 inches square.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of NCDOT Standard Specifications for pavement-marking work.
1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for alkyd materials and 55 deg F for water-based materials, and not exceeding 95 deg F.

B. Thermoplastic Pavement-Markings: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient and pavement surface temperature of 55° F. Maximum pavement temperature shall not exceed 160° F at time of thermoplastic application.

1.7 WARRANTY

A. Warranty: Replace pavement markings that prematurely deteriorate, failed to adhere to the pavement, lack reflectivity (if applicable) or are otherwise unsatisfactory during the life of the project.

PART 2 - PRODUCTS

2.1 PAVEMENT-MARKINGING PAINT

A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N; colors complying with FS TT-P-1952.

1. Color: As indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.2 PAVEMENT MARKING

A. Do not apply thermoplastic pavement markings until layout, colors, and placement have been verified with Designer.

B. Allow paving to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

3.3 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.4 MAINTENANCE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance. Include monthly preventive maintenance, repair or replacement of worn or defective components as required at no cost to the Owner.

END OF SECTION 32 17 23

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Lawn Seeding
2. Lawn Sodding
3. Meadow grasses and wildflowers

B. Related Sections:
1. Section 311000 "Site Clearing" for topsoil stripping and stockpiling.
2. Section 329300 "Plants" for planting installation.
3. Section 334600 “Subdrainage” for perforated pipe placement.

1.3 DEFINITIONS

A. Substantial Completion: The proper installation of seed, sod, and meadow with final grades, mulch and irrigation functioning (if provided) with no indication of widespread plant death. For seeded and meadow areas, the seed must show germination with green shoots visible. It is possible to grant substantial completion to portions of the site without total project completion however all construction activities must be completed in the requested area.

B. Finish Grade: Elevation of finished surface of planting soil. Refer to Section

C. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

D. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

E. Planting Soil: Existing or imported as specified in 329100 Planting Soil that has been tested and amended as necessary for use as soil for the establishment of planting and turf areas.

F. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

G. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

H. Turf: A groundcover established from either lawn type seeds, lawn type sod or meadow seeds.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.

1.5 INFORMATIONAL SUBMITTALS

A. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
   1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.

B. Qualification Data: For qualified landscape Installer.

C. Product Certificates: For soil amendments and fertilizers, from manufacturer.

D. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf and meadows during a calendar year. Submit before expiration of required initial maintenance periods.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf and meadow establishment.
   1. Professional Membership: Installer shall be a member in good standing of the Professional Landcare Network, the NC Landscape Contractors Association, or the American Nursery and Landscape Association.
   2. Experience: Three years' experience in turf installation in addition to requirements in Division 01 Section "Quality Requirements."
   3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
   4. Personnel Certifications: All personel who handle herbicides and herbicides shall be State licensed, for commercial.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

C. Bulk Materials:
   1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

1.8 PROJECT CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.
Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

Grass Type	Fall Season	Spring Season
Cool season grasses	September 15- December 15	February 1 to May 15
Warm season grasses	Sept 1 to Oct 15	May 15- July 15
Grassy Meadows	Sept 1 to Oct 15	May 15- July 15

B. Construction Water: During the construction period water will be provided by the Contractor.

C. Construction Maintenance Water: During the maintenance period water will be provided by the Contractor

D. Initial Maintenance Service for Lawns [sod and seed areas]: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after lawns are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.

1. Construction Maintenance Period for areas that are completed prior to Final Completion and Acceptance for entire project: 6 months. The Construction Maintenance Period will begin from the date of Substantial Completion for the last sub-phase of work completed, not the final phase of the project. Partial substantially completed areas will require continued maintenance until the Final Completion date set by the final phase of work.

2. Landscape Maintenance Period: 12 monthsfrom Substantial Completion of entire project- The Maintenance Period will begin from the date the Maintenance period [described above] lapses.

E. Meadow Construction Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable meadow is established, but for not less than 6 months from date of Substantial Completion. Partial substantially completed areas will require continued maintenance until the completion date set by the final phase of work.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

Lawn Type	Seed Mix	Notes
Warm Season Lawn	Common Bermuda	
Cool Season	Turf Type Fescue	
Cool Season	Triple-Threat Turf Type Fescue	

2.2 TURFGRASS SOD

A. Turfgrass Sod: Provide sod meeting "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Species: (SELECT BELOW FOR YOUR PROJECT SPECIFICS)

Lawn Type	Turfgrass Sod Species	Notes
Warm Season Lawn	Common Bermuda	
Warm Season Lawn	Tifway 419 Bermudagrass	
Warm Season Lawn	Tifgrand Bermudagrass	
Warm Season Lawn	Patriot (OKC 18-4) Bermudagrass	
Warm Season Lawn	Zenith Zoysia	
Warm Season Lawn	Emerald Zoysia	
Cool Season	Turf Type Fescue	
Cool Season	Triple-Threat Turf Type Fescue	

2.3 SEED STABILIZATION

A. Grass and meadow seed blankets and coverings:.
1. Products for lawn areas: Free of plastic or other non-biodegradable materials, seed free; available products that may be incorporated into the Work include, but are not limited to, the following:
   a. American Excelsior Company, Curlex NetFree
   b. Granite Environmental, Coconut Blanket C4000BD
   c. Tensar BioNet

2.4 MULCHES

A. General: The Contractor shall select the mulching products that best suit the grass seed selected. Choose from the following mulches:
   1. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
   2. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

B. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

2.5 PESTICIDES

A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance. Notify the Architect immediately and do not start landscape construction operations if:
   1. Grades or site features do not match the design.
   2. There is ponding or areas that do not appear to drain
   3. The subsoil contains no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
   4. If the soils are frozen or moist beyond that required to produce optimal working conditions.
   5. Excessively dry soil that is not workable and which is too dusty.
   6. If the subsoil is over compacted.
   7. If irrigation main and lateral lines have not been installed.
   8. If irrigation main or lateral line trenches have not been compacted.
   9. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Erosion Control Seeding Contamination – Evaluate the erosion control seeding used and confirm that potential seed sources will not interfere with the establishment of seeded lawns or meadows. Confer with the General Contractor on usage of erosion control seeding and potential threats to establishing lawns or meadows.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
   1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
   2. Protect grade stakes set by others until directed to remove them.
   3. Protect areas that should not receive seed such as planting beds.

3.3 TURF AREA PREPARATION

A. Subgrade: Limit turf subgrade preparation to areas to be planted. Loosen subgrade as specified in 329100 “Planting Soil.”

B. Planting Soil: Refer to specification section 329100 “Planting Soils.”

C. Finish Grade: Refer to 329119 “Planting Area Finish Grading.”

D. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

E. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 LAWN SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
   1. Do not use wet seed or seed that is moldy or otherwise damaged.
   2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at rates as specified by seed provider.

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with erosion-control mats where slopes exceed 3:1 and as shown on Drawings; install and anchor according to manufacturer's written instructions.

E. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a rate to form a continuous blanket 1 inch in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
   1. Bond straw mulch by spraying with non-asphalt emulsion at a rate to resist wind and erosion. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

F. Protect seeded areas from hot, dry weather or drying winds by applying hydromulch within 4 hours after completing seeding operations.

3.5 HYDROSEEDING

A. Two Step Hydroseeding: Mix specified seed and fertilizer in water, using equipment specifically designed for hydroseed application.

B. Apply seed and fertilizer at the recommended rates to bare soil.

C. Apply hydromulch over seed mix. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
   1. Mix slurry with nonasphaltic tackifier.
   2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight.

3.6 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
   1. Lay sod across angle of slopes exceeding 1:3.
   2. Anchor sod on slopes exceeding 1:6 or in the bottom of swales with steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.7 TURF MAINTENANCE

A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
   1. Repair turf as necessary because of settling, erosion or settlement or other processes.
   2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
   3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain irrigation systems, temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches .
   1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
   2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
   1. Mow bermudagrass to a height of 1/2 to 1 inch.
   2. Mow turf-type tall fescue to a height of 2 to 3 inches.

D. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.
   1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.8 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:
   1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 3 by 3 inches.
   2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
   3. Satisfactory Plugged Turf: At end of maintenance period, the required number of plugs has been established as well-rooted, viable patches of grass, and areas between plugs are free of weeds and other undesirable vegetation.
   4. Satisfactory Sprigged Turf: At end of maintenance period, the required number of sprigs has been established as well-rooted, viable plants, and areas between sprigs are free of weeds and other undesirable vegetation.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.9 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.10 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION 32 92 00

SECTION 33 12 00 – WATER UTILITY DISTRIBUTION EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes water-distribution piping and specialties outside the building for the following:
   1. Water services.
   2. Fire-service mains.
   3. Combined water service and fire-service mains.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.3 DEFINITIONS

A. Combined Water Service and Fire-Service Main: Exterior water piping for both domestic-water and fire-suppression piping.

B. Fire-Service Main: Exterior fire-suppression-water piping.

C. Fire-Suppression-Water Piping: Interior fire-suppression-water piping.

D. Water-Distribution Piping: Interior domestic-water piping.

E. Water Service: Exterior domestic-water piping.

F. The following are industry abbreviations for plastic materials:
   1. PA: Polyamide (nylon) plastic.
   2. PE: Polyethylene plastic.
   3. PP: Polypropylene plastic.
   4. PVC: Polyvinyl chloride plastic.
   5. DIP: Ductile Iron Pipe

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Piping specialties.
   2. Valves and accessories.
   3. Water meters and accessories.
   4. Backflow preventers and assemblies.
   5. Protective enclosures.

6. Fire hydrants.
7. Flushing hydrants.
8. Fire department connections.
9. Alarm devices.
10. Post hydrants.
11. Drinking fountains.

B. Shop Drawings: For the following:
1. Precast concrete vaults, including frames and covers, ladders, and drains.
2. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: For piping and specialties including relation to other services in same area. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

D. Field Quality-Control Test Reports: From Contractor.

E. Operation and Maintenance Data: For specialties to include in emergency, operation, and maintenance manuals. Include the following product data for Operation and Maintenance Manual:
1. Water meters.
2. Valves.
3. Backflow preventers.
4. Protective enclosures.
5. Fire hydrants.
6. Flushing hydrants.
7. Post hydrants.
8. Drinking fountains.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of piping and specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Regulatory Requirements:
1. Comply with requirements of utility company or local jurisdiction supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

C. Piping materials shall bear label, stamp, or other markings of specified testing agency.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

F. Comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

G. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

H. NSF Compliance:
1. Comply with NSF 14 for plastic potable-water-service piping.
2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner's Representative not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's Representative written permission.

1.8 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated.

B. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Ductile-Iron Flexible Expansion Joints: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

D. Ductile-Iron Deflection Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

E. Ductile-Iron Expansion Joints: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

2.2 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper.
   1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

B. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

C. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.3 PVC PIPE AND FITTINGS

A. PVC, AWWA Pipe: AWWA C900, Class 200, with bell end with gasket and spigot end.

B. Comply with UL 1285 for fire-service mains if indicated.

C. PVC Fabricated Fittings: AWWA C900, Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

D. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

E. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
1. Gaskets: AWWA C111, rubber.

F. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.4 JOINING MATERIALS

A. Transition Couplings:
1. Underground Piping, NPS 1-1/2 and Smaller: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
2. Underground Piping, NPS 2 and Larger: AWWA C219, metal, sleeve-type coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
3. Aboveground or Vault Piping: Pipe fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

C. Soldering Flux: ASTM B 813, water-flushable type.

D. Solder Filler Metal: ASTM B 32, lead-free type with 0.20 percent maximum lead content.

E. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.5 PIPING SPECIALTIES

A. Flexible Connectors:
1. Nonferrous-Metal Piping: Bronze hose covered with bronze wire braid; with copper-tube, pressure-type, solder-joint ends or bronze flanged ends brazed to hose.
2. Ferrous Piping: Stainless-steel hose covered with stainless-steel wire braid; with ASME B1.20.1, threaded steel pipe nipples or ASME B16.5, steel pipe flanges welded to hose.

B. Dielectric Fittings: Combination of copper alloy and ferrous; threaded, solder, or plain end types; and matching piping system materials.

1. Dielectric Unions: Factory-fabricated union assembly, designed for 250-psig minimum working pressure at 180 deg F . Include insulating material that isolates dissimilar metals and ends with inside threads according to ASME B1.20.1.
2. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 150- or 300-psig minimum working pressure to suit system pressures.
3. Dielectric-Flange Insulation Kits: Field-assembled companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
    a. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure to suit system pressures.
4. Dielectric Couplings: Galvanized-steel couplings with inert and noncorrosive thermo-plastic lining, with threaded ends and 300-psig minimum working pressure at 225 deg F.
5. Dielectric Nipples: Electroplated steel nipples with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig minimum working pressure at 225 deg F .

2.6 CORROSION-PROTECTION ENCASEMENT FOR PIPING

A. Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch minimum thickness, tube or sheet.

2.7 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:
1. Manufacturers: Subject to compliance with requirement, provide products by one of the following as approved by the local jurisdiction and pre-approved by the Designer:
    a. American AVK Co.; Valves & Fittings Div.
    b. American Cast Iron Pipe Co.; American Flow Control Div.
    c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
    d. Crane Co.; Crane Valve Group; Stockham Div.
    e. East Jordan Iron Works, Inc.
    f. Grinnell Corporation; Mueller Co.; Water Products Div.
    g. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
    h. McWane, Inc.; Kennedy Valve Div.
    i. McWane, Inc.; Tyler Pipe; Utilities Div.
    j. NIBCO INC.
    k. United States Pipe and Foundry Company.
2. Nonrising-Stem, Metal-Seated Gate Valves: AWWA C500, gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.
    a. Minimum Working Pressure: 200 psig.
    b. End Connections: Mechanical joint.

c. Interior Coating: Complying with AWWA C550.

3. Nonrising-Stem, Resilient-Seated Gate Valves: AWWA C509, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

a. Minimum Working Pressure: 200 psig.

b. End Connections: Mechanical joint.

c. Interior Coating: Complying with AWWA C550.

4. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves: AWWA C509, ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.

a. Minimum Working Pressure: 250 psig.

b. End Connections: Push-on or mechanical joint.

c. Interior Coating: Complying with AWWA C550.

5. OS&Y, Rising-Stem, Metal-Seated Gate Valves: AWWA C500, cast-iron or ductile-iron body and bonnet, outside screw and yoke, cast-iron double disc, bronze disc and seat rings, and bronze stem.

a. Minimum Working Pressure: 200 psig.

b. End Connections: Flanged.

6. OS&Y, Rising-Stem, Resilient-Seated Gate Valves: AWWA C509, cast-iron or ductile-iron body and bonnet, outside screw and yoke; with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.

a. Minimum Working Pressure: 200 psig.

b. End Connections: Flanged.

B. UL/FM, Cast-Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirement, provide products by one of the following as approved by the local jurisdiction and pre-approved by the Designer:

a. American Cast Iron Pipe Co.; American Flow Control Div.

b. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.

c. Central Sprinkler Company.

d. Crane Co.; Crane Valve Group; Stockham Div.

e. Grinnell Corporation.

f. Grinnell Corporation; Mueller Co.; Water Products Div.

g. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).

h. McWane, Inc.; Kennedy Valve Div.

i. McWane, Inc.; M & H Valve Company Div.

j. NIBCO INC.

k. United States Pipe and Foundry Company.

2. UL/FM, Nonrising-Stem Gate Valves: UL 262, FM-approved iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.
   a. Minimum Working Pressure: 175 psig.
   b. End Connections: Flanged.
3. OS&Y, Rising-Stem Gate Valves: UL 262, FM-approved iron body and bonnet, bronze seating material, and outside screw and yoke.
   a. Minimum Working Pressure: 175 psig.
   b. End Connections: Flanged.

C. Bronze Gate Valves:
1. Manufacturers: Subject to compliance with requirement, provide products by one of the following as approved by the local jurisdiction and pre-approved by the Designer:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Jenkins Valves.
   c. Crane Co.; Crane Valve Group; Stockham Div.
   d. Grinnell Corporation.
   e. Hammond Valve.
   f. Milwaukee Valve Company.
   g. NIBCO INC.
   h. Red-White Valve Corp.
2. OS&Y, Rising-Stem Gate Valves: UL 262, FM-approved bronze body and bonnet, outside screw and yoke, and bronze stem.
   a. Minimum Working Pressure: 175 psig.
   b. End Connections: Threaded.
3. Nonrising-Stem Gate Valves: MSS SP-80, Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.

2.8 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies: Comply with MSS SP-60. Include sleeve and valve compatible with drilling machine.
1. Manufacturers: Subject to compliance with requirement, provide products by one of the following as approved by the local jurisdiction and pre-approved by the Designer:
   a. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
   b. East Jordan Iron Works, Inc.
   c. Grinnell Corporation; Mueller Co.; Water Products Div.
   d. International Piping Services Company.
   e. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
   f. McWane, Inc.; Kennedy Valve Div.

g. McWane, Inc.; M & H Valve Company Div.

h. United States Pipe and Foundry Company.

2. Tapping Sleeve: Cast- or ductile-iron or stainless steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.

3. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," bottom section with base of size to fit over valve, and approximately 5-inch- diameter barrel.
1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FM-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

D. Indicator Posts: UL 789, FM-approved, horizontal, wall-type, cast-iron body with operating wrench, extension rod, and cast-iron barrel.

2.9 CHECK VALVES

A. AWWA Check Valves:
1. Manufacturers: Subject to compliance with requirement, provide products by one of the following as approved by the local jurisdiction and pre-approved by the Designer:

a. American AVK Co.; Valves & Fittings Div.

b. American Cast Iron Pipe Co.; American Flow Control Div.

c. Crane Co.; Crane Valve Group; Crane Valves.

d. Crane Co.; Crane Valve Group; Stockham Div.

e. Grinnell Corporation; Mueller Co.; Water Products Div.

f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).

g. McWane, Inc.; Kennedy Valve Div.

h. McWane, Inc.; M & H Valve Company Div.

i. NIBCO INC.

j. Valve and Primer Corp.

k. Watts Industries, Inc.; Water Products Div.

2. Check Valves: AWWA C508, swing-check type with 175-psig working-pressure rating and resilient seat. Include interior coating according to AWWA C550 and ends to match piping.

B. UL-Labeled Check Valves:
1. Manufacturers: Subject to compliance with requirement, provide products by one of the following as approved by the local jurisdiction and pre-approved by the Designer:

a. AFAC, Inc.; Badger Fire Protection.
b. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
c. Central Sprinkler Company.
d. Crane Co.; Crane Valve Group; Stockham Div.
e. Firematic Sprinkler Devices, Inc.
f. Globe Fire Sprinkler Corporation.
g. Grinnell Corporation.
h. Grinnell Corporation; Mueller Co.; Water Products Div.
i. Matco-Norca, Inc.
j. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
k. McWane, Inc.; Kennedy Valve Div.
l. NIBCO INC.
m. Reliable Automatic Sprinkler Co., Inc.
n. Star Sprinkler, Inc.
o. United Brass Works, Inc.
p. Venus Fire Protection, Ltd.
q. Victaulic Co. of America.
r. Viking Corporation.
s. Watts Industries, Inc.; Water Products Div.

2. Check Valves: UL 312, swing-check type with 175-psig working-pressure rating, rubber-face checks unless otherwise indicated, and ends matching piping.
3. Check Valves: UL 312, swing-check type with 250-psig working-pressure rating, rubber-faced checks unless otherwise indicated, and ends matching piping.

2.10 CORPORATION VALVES AND CURB VALVES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following as approved by the local jurisdiction and pre-approved by the Designer:
1. Amcast Industrial Corporation; Lee Brass Co.
2. Ford Meter Box Company, Inc. (The).
3. Grinnell Corporation; Mueller Co.; Water Products Div.
4. Jones, James Company.
5. Master Meter, Inc.
6. McDonald, A. Y. Mfg. Co.
7. Red Hed Manufacturing Co.

B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

C. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

D. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," bottom section with base of size to fit over curb valve, and approximately 3-inch-diameter barrel.
1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.11 WATER-REGULATING VALVES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following as approved by the local jurisdiction and pre-approved by the Designer:
1. Ames Co., Inc.
2. BERMAD.
3. Cla-Val Co.
4. GA Industries, Inc.
5. IMI Cash Valve, Inc.
6. OCV Control Valves.
7. Watts Industries, Inc.; Water Products Div.

B. Pressure-Regulating Valves: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. Include 250-psig working-pressure design, bronze pressure-reducing pilot valve and tubing, and means for discharge pressure adjustment.

C. Flow-Regulating Valves: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. Include 250-psig working-pressure design, bronze pressure-reducing pilot valve and tubing, and means for flow adjustment.

2.12 RELIEF VALVES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following as approved by the local jurisdiction and pre-approved by the Designer:
1. BERMAD.
2. GA Industries, Inc.
3. MULTIPLEX Manufacturing Co.
4. OCECO, Inc.
5. Val-Matic Valve & Mfg. Corp.

B. Air-Release Valves: AWWA C512, hydromechanical device to automatically release accumulated air. Include 300-psig working-pressure design.

C. Air/Vacuum Valves: AWWA C512, direct-acting, float-operated, hydromechanical device with large orifice to automatically release accumulated air or to admit air during filling of piping. Include 300-psig working-pressure design.

D. Combination Air Valves: AWWA C512, float-operated, hydromechanical device to automatically release accumulated air or to admit air. Include 300-psig working-pressure design.

2.13 DETECTOR CHECK VALVES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following as approved by the local jurisdiction and pre-approved by the Designer:
1. Ames Co., Inc.
2. Badger Meter, Inc.
3. CMB Industries, Inc.; Febco Div.
4. Firematic Sprinkler Devices, Inc.
5. Globe Fire Sprinkler Corporation.
6. Grinnell Corporation; Mueller Co.; Hersey Meters.
7. McWane, Inc.; Kennedy Valve Div.
8. Smith-Blair, Inc.
9. Victaulic Co. of America.
10. Viking Corporation.
11. Watts Industries, Inc.; Water Products Div.

B. Detector Check Valves: UL 312, galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends; designed for 175-psig working pressure. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.
1. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.

C. Detector Check Valves: UL 312, FM-approved detector check, iron body, corrosion-resistant clapper ring and seat ring material, 175-psig working pressure, flanged ends, with connections for bypass and installation of water meter.

2.14 WATER METERS

A. Water meters will be furnished by utility company or local jurisdiction unless noted otherwise on the plans.

B. Manufacturers: Subject to compliance with requirement, provide products by one of the following as approved by the local jurisdiction and pre-approved by the Designer:
1. ABB Water Meters, Inc.

2. Badger Meter, Inc.
3. Carlon Meter Co.
4. Grinnell Corporation; Mueller Co.; Hersey Meters.
5. ROMAC Industries, Inc.; Hays Fluid Control Div.
6. Schlumberger Limited; Water Div.
7. Sensus Technologies, Inc.
8. Water Specialties Corp.

C. Description: AWWA C700, displacement-type, bronze main case. Register flow in gallons unless cubic feet are indicated.

D. Description: AWWA C701, turbine type. Register flow in gallons unless cubic feet are indicated.

E. Description: AWWA C702, compound-type, bronze case. Register flow in gallons unless cubic feet are indicated.

F. Remote Registration System: Utility company standard; direct-reading type complying with AWWA C706. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.

G. Remote Registration System: Utility company standard; encoder type complying with AWWA C707. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
1. Data-Acquisition Units: Comply with utility company requirements for type and quantity.
2. Visible Display Units: Comply with utility company requirements for type and quantity.

2.15 DETECTOR-TYPE WATER METERS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following as approved by the local jurisdiction and pre-approved by the Designer:
1. Badger Meter, Inc.
2. Grinnell Corporation.
3. Grinnell Corporation; Mueller Co.; Hersey Meters.
4. Schlumberger Limited; Water Div.
5. Sensus Technologies, Inc.

B. Description: AWWA C703, UL-listed, FM-approved, main line, proportional, detector type, 150-psig working pressure, with meter on bypass. Register flow in gallons unless cubic feet are indicated.
1. Bypass Meter: AWWA C701, turbine -type, bronze case; at least one-half nominal size of main-line meter.

C. Description: AWWA C703, UL-listed, FM-approved, main-line turbine, detector type, 175-psig working pressure, with strainer and with meter on bypass. Register flow in gallons unless cubic feet are indicated.

1. Bypass Meter: AWWA C701, turbine type; at least NPS 2.

D. Remote Registration System: Utility company standard; direct-reading type complying with AWWA C706. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.

E. Remote Registration System: Utility company standard; encoder type complying with AWWA C707. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
1. Data-Acquisition Units: Comply with utility company requirements for type and quantity.
2. Visible Display Units: Comply with utility company requirements for type and quantity.

2.16 WATER-METER BOXES

A. Description: Cast-iron body and cover for disc-type water meter with lettering "WATER METER" in cover; and slotted, open-bottom base section of length to fit over service piping.
1. Option: Base section may be cast-iron, PVC, clay, or other pipe.

B. Description: Cast-iron body and double cover for disc-type water meter with lettering "WATER METER" in top cover; separate inner cover; air space between covers; and slotted, open-bottom base section of length to fit over service piping.

C. Description: Polymer-concrete body and cover for disc-type water meter with lettering "WATER" in cover; and slotted, open-bottom base section of length to fit over service piping. Include vertical and lateral design loadings of 15,000 lb minimum over 10 by 10 inches square.

2.17 HOSE-CONNECTION, BACKFLOW-PREVENTION DEVICES

A. General: ASSE standard, nonremovable-type, backflow-prevention devices with ASME B1.20.7, garden-hose threads on outlet.

B. Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with manual drain feature. Units attached to rough-bronze-finish hose connections may be rough bronze.

C. Hose-Connection Backflow Preventers: ASSE 1052, suitable for at least 3-gpm flow and applications with up to 10-foot head of water back pressure. Include two check valves and intermediate atmospheric vent.

2.18 BACKFLOW PREVENTERS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following as approved by the local jurisdiction and pre-approved by the Designer:
1. Verify approved manufacturers and model with the City of Raleigh Backflow Prevention Approved Assembly list.
a. Ames Co., Inc.
b. Apollo/Conbraco
c. ARI
d. Cash Acme
e. FEBCO

f. Watts Industries, Inc.; Water Products Div.

g. Zurn Industries, Inc.; Wilkins Div.

B. General: ASSE 1013 standard, backflow preventers.
1. Working Pressure: 175 psig minimum, unless otherwise indicated.
2. NPS 2 and Smaller: Bronze body with threaded ends.
3. NPS 2-1/2 and Larger: cast-iron, steel, or stainless-steel body with flanged ends.
   a. Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast-iron or steel body.
4. Interior Components: Corrosion-resistant materials.
5. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.
6. Strainer: On inlet.
7. Lead Free Compliant

C. Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.

D. Reduced-Pressure-Principle Backflow Preventers: AWWA C511, suitable for continuous pressure application. Include a single torsion spring; strainer on inlet; four ball type test cocks; and pressure differential relief valve, air-gap fitting located between two positive-seating check valves.
1. Maximum Pressure Loss: 8 psig through middle 1/3 of flow range.

E. Double-Check-Valve Backflow Prevention Assemblies: AWWA C510, suitable for continuous pressure application. Include outside screw slotted ball valve test cocks; and two positive-seating check valves; integral shutoff valves.
1. Maximum Pressure Loss: 4 psig through 1/2 of flow range.

2.19 PROTECTIVE ENCLOSURES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following as approved by the City of Raleigh and pre-approved by the Designer:
1. G&C Enclosures, Inc.
2. Hot Box, Inc.
3. HydroCowl, Inc.
4. Watts Industries, Inc.; Water Products Div.

B. Protective Enclosures, General: ASSE 1060, outdoor weather-resistant enclosure designed to protect aboveground water piping equipment or specialties from vandalism. Include size and dimensions indicated but not less than those required for access and service of protected unit.

C. Freeze-Protection Enclosures: Insulated and with heat source to maintain minimum internal temperature of 40 deg F (4 deg C) when external temperatures reach as low as minus 34 deg F (minus 36 deg C).
1. Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.

2. Class I-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.
   a. Housing: Reinforced aluminum or fiberglass construction.
      1) Drain opening for units with drain connection.
      2) Access doors with locking devices.
      3) Insulation inside housing.
      4) Anchoring devices for attaching housing to concrete base.
   b. Electric heating cable or heater with self-limiting temperature control.

D. Precast concrete base of dimensions required to extend at least 6 inches beyond edges of enclosure housings. Include openings for piping.

2.20 CONCRETE VAULTS

A. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C 857 and made according to ASTM C 858.

B. Ladder: ASTM A 36/A 36M, steel or polyethylene-encased steel steps.

C. Manhole: ASTM A 48, Class No. 35 minimum tensile strength, gray-iron traffic frame and cover.
   1. Dimensions: Not smaller than 24-inch diameter, unless otherwise indicated.

D. Manhole: ASTM A 536, Grade 60-40-18, ductile-iron, 24-inch- minimum-diameter traffic frame and cover.

E. Drain: ASME A112.21.1M, cast-iron floor drain with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

2.21 PROTECTIVE ENCLOSURES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following as approved by the local jurisdiction and pre-approved by the Designer:
   1. G&C Enclosures, Inc.
   2. Hot Box, Inc.
   3. HydroCowl, Inc.
   4. Watts Industries, Inc.; Water Products Div.

B. Protective Enclosures, General: ASSE 1060, outdoor weather-resistant enclosure designed to protect aboveground water piping equipment or specialties from vandalism. Include size and dimensions indicated but not less than those required for access and service of protected unit.

C. Freeze-Protection Enclosures: Insulated and with heat source to maintain minimum internal temperature of 40 deg F (4 deg C) when external temperatures reach as low as minus 34 deg F (minus 36 deg C).
   1. Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.

2. Class I-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.
    a. Housing: Reinforced aluminum or fiberglass construction.
        1) Drain opening for units with drain connection.
        2) Access doors with locking devices.
        3) Insulation inside housing.
        4) Anchoring devices for attaching housing to concrete base.
    b. Electric heating cable or heater with self-limiting temperature control.

D. Nonfreeze-Protection Enclosures: Noninsulated and without heat source.
1. Class III: For equipment or devices other than pressure or atmospheric vacuum breakers.
2. Class III-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.
    a. Housing: Reinforced aluminum or fiberglass construction.
        1) Drain opening for units with drain connection.
        2) Access doors with locking devices.
        3) Anchoring devices for attaching housing to concrete base.

E. Precast concrete base of dimensions required to extend at least 6 inches beyond edges of enclosure housings. Include openings for piping.

2.22 FREESTANDING FIRE HYDRANTS

A. All Hydrants shall meet local jurisdiction requirements and standards. Contractor to verify with local engineering/inspection department or fire department for standard requirements. The list below is for informational purposes only.

B. Dry-Barrel Fire Hydrants: AWWA C502, one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure, and 150-psig minimum working-pressure design.

C. Dry-Barrel, High-Pressure Fire Hydrants: AWWA C502, one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure, and 250-psig minimum working-pressure design.

D. CITY OF RALEIGH ONLY: Dry-Barrel, High-Pressure Fire Hydrants: AWWA C502, one 5” Storz connection nozzle and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure, and 250-psig minimum working-pressure design.
1. Manufacturers: Subject to compliance with requirement, provide products by one of the following as approved by the local jurisdiction and pre-approved by the Designer:

a. Check with local standard requirements for approved manufacturers; List below should be verified with local requirements.

1) Kennedy.

2) Mueller.

3) Clow.

4) American Darling.

5) M&H.

6) AVK.

7) East Jordan Iron Works.

8) US Pipe.

2. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.

3. Edit first two subparagraphs below if required by authorities having jurisdiction.

4. Operating and Cap Nuts: Pentagon, 1-1/2 inches point to flat.

5. Direction of Opening: Open hydrant valve by turning operating nut to left or counter-clockwise.

6. Exterior Finish: Per local fire department or jurisdiction.

2.23 FLUSHING HYDRANTS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following as approved by the local jurisdiction and pre-approved by the Designer:
1. GIL Industries, Inc.

2. Grinnell Corporation; Mueller Co.; Water Products Div.

3. Kupferle Foundry Co. (The).

B. Description: Nonfreeze and drainable, with 150-psig minimum working-pressure rating and of length required for shutoff valve installation below frost line. Include one operating wrench for each unit.

C. Post-Type Flushing Hydrants:
1. Outlet: One, with horizontal discharge.

2. Hose Thread: NPS 2-1/2 ,with NFPA 1963 external hose thread for use by local fire department and cast-iron cap with brass chain.

3. Barrel: Cast-iron or steel pipe with breakaway feature.

4. Valve: Bronze body with bronze-ball or plunger closure, and automatic draining.

5. Security: Locking device for padlock.

6. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

7. Inlet: NPS 2 minimum.

D. Ground-Type Flushing Hydrants:

1. Outlet: One, with angle discharge.
2. Hose Thread: NPS 2-1/2, with NFPA 1963 external hose thread for use by local fire department and cast-iron cap with brass chain.
3. Barrel: Cast-iron or steel pipe.
4. Valve: Bronze body with bronze-ball or plunger closure, and automatic draining.
5. Inlet: NPS 2 minimum.
6. Hydrant Box: Cast iron with cover, for ground mounting.

E. Post-Type Sampling Station:
1. Sampling Outlet: One unthreaded nozzle with handle.
2. Valve: Bronze body with bronze-ball or plunger closure. Include operating handle.
3. Drain: Tubing with separate manual vacuum pump.
4. Inlet: NPS 3/4 minimum.
5. Housing: Weatherproof material with locking device. Include anchor device.

2.24 FIRE DEPARTMENT CONNECTIONS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following as approved by the local jurisdiction and pre-approved by the Designer:
1. AFAC, Inc.; Badger Fire Protection.
2. Elkhart Brass Mfg. Co., Inc.
3. Fire End & Croker Corporation.
4. Firematic Sprinkler Devices, Inc.
5. Grinnell Corporation.
6. Guardian Fire Equipment, Inc.
7. Reliable Automatic Sprinkler Co., Inc.
8. Smith Industries, Inc.; Potter-Roemer Div.

B. Exposed, Freestanding, Fire Department Connections: UL 405, cast-bronze body, with thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- high brass sleeve; and round escutcheon plate.

C. Connections to be per local jurisdiction unless none exist then:
1. Connections: Two NPS 2-1/2 inlets and one NPS 4 outlet.
2. Connections: Three NPS 2-1/2 inlets and one NPS 6 outlet.
3. Connections: Six NPS 2-1/2 inlets and one NPS 8 outlet.
4. Inlet Alignment: Inline.
5. Finish Including Sleeve: Polished bronze.
6. Escutcheon Plate Marking: "STANDPIPE."

2.25 ALARM DEVICES

A. Description: UL 753, FM approved, of types and sizes to mate and match piping and equipment.

B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig working pressure; designed for horizontal or vertical installation; with 2 single-pole, double-throw circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.

C. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.

D. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

PART 3 - EXECUTION

3.1 EARTHWORK

A. See Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

C. Do not use flanges, unions, or keyed couplings for underground piping.

D. Flanges, unions, keyed couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground Water-Service Piping and or Fire Service Main Piping: Use the following piping materials for each size range as indicated by the Drawings or per local jurisdiction standard construction specifications;

1. Piping listed in subparagraphs below for potable-water service may not be suitable for fire-protection water service.
2. NPS 3/4 to NPS 2 Soft copper tube, Type K; wrought-copper fittings; and or soldered joints.
3. NPS 3/4 to NPS 2 PVC, Schedule 80 pipe; Schedule 80 socket fittings; and solvent-cemented joints.
4. NPS 2 - 12 : Ductile-iron, push-on-joint pipe; ductile-iron, class 350.
5. NPS 2 to NPS 12 : PVC, AWWA Class 200 pipe listed for fire-protection service; PVC fabricated or molded fittings of same class as pipe; and gasketed joints.

F. Vault Water-Service Piping: Use the following piping materials for each size range as indicated on the drawings
1. NPS 3/4 to NPS 2 Soft copper tube, Type K; wrought-copper fittings; and brazed or soldered joints.
2. NPS 3/4 to NPS 2 PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.
3. NPS 2 - 12 : Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
4. NPS 2 - 12 : PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.
5. Vault Fire-Service-Main Piping: Ductile-iron pipe with grooved ends; ductile-iron, grooved-end fittings; ductile-iron keyed couplings; and grooved joints.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FM, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, resilient - seated gate valves with valve box.
2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FM, cast-iron, nonrising-stem gate valves with indicator post.
3. Use the following for valves in vaults and aboveground:
    a. Gate Valves, NPS 2 and Smaller: Bronze, nonrising stem.
    b. Gate Valves, NPS 3 and Larger: AWWA and UL/FM approved, cast iron, OS&Y rising stem, resilient seated.
    c. Check Valves: AWWA C508 and UL/FM, swing-check valves.
4. Water-Regulating Valves: Use for water-service piping in vaults and aboveground.
    a. Pressure-Regulating Valves: To control water pressure.
    b. Flow-Regulating Valves: To control water flow.
5. Relief Valves: Use for water-service piping in vaults and aboveground.
    a. Air-Release Valves: To release accumulated air.
    b. Air/Vacuum Valves: To release or admit large volume of air during filling of piping.
    c. Combination Air Valves: To release or admit air.
6. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.

3.4 JOINT CONSTRUCTION

A. See Division 2 Section "Utility Materials" for basic piping joint construction.

B. Make pipe joints according to the following:
   1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
   2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
   3. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with keyed couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
   4. Copper Tubing Soldered Joints: ASTM B 828. Use flushable flux and lead-free solder.
   5. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
   6. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
   7. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 2 Section "Utility Materials" for joining piping of dissimilar metals.

3.5 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 with tapping machine according to the following:
   1. Install tapping sleeve and tapping valve according to MSS SP-60.
   2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
   3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
   4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Make connections NPS 2 and smaller with drilling machine according to the following:
   1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
   2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
   3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
   4. Install corporation valves into service-saddle assemblies.
   5. Install manifold for multiple taps in water main.

6. Install curb valve in water-service piping with head pointing up and with service box.

E. Comply with NFPA 24 for fire-service-main piping materials and installation.
1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.

F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.

G. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

H. Install PVC, AWWA pipe according to AWWA M23 and ASTM F 645.
1. Install PE pipe according to ASTM D 2774 and ASTM F 645.

I. Install PEX tubing according to ASTM D 2774 and ASTM F 645.

J. Bury piping with depth of cover over top as indicated on the drawings or as required by the local jurisdiction.

K. Install piping by tunneling, jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

L. Extend water-service piping and connect to water-supply source and building water piping systems at outside face of building wall in locations and pipe sizes indicated.
1. Terminate water-service piping at building wall until building water piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building water piping systems when those systems are installed.

M. Sleeves are specified in Division 2 Section "Utility Materials.

N. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

O. Anchor service-entry piping to building wall.

P. See Division 15 Section "Domestic Water Piping" for potable-water piping inside the building.

Q. See Division 13 Sections for fire-suppression water piping inside the building.

R. Install trap below frost line on drain outlet of each drinking fountain.

3.6 ANCHORAGE INSTALLATION

A. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.

B. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.

C. Fire-Service-Main Piping: According to NFPA 24.

D. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.7 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. UL/FM Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

C. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

D. Water-Regulating Valves: Install in vault or aboveground between shutoff valves.

E. Relief Valves: Install aboveground with shutoff valve on inlet.

F. Detector Check Valves: Install in vault or aboveground.

3.8 DETECTOR CHECK VALVE INSTALLATION

A. Install detector check valves for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.

B. Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.

3.9 WATER-METER INSTALLATION

3.10 Install water meters, piping, and specialties according to utility company's written requirements.

A. Water Meters: Install displacement-type water meters, NPS 2 and smaller, in meter boxes with shutoff valves on water-meter inlets. Include valves on water-meter outlets and valved bypass around meters unless prohibited by authorities having jurisdiction.

B. Water Meters: Install compound-type water meters, NPS 3 and larger, in meter vaults. Include shutoff valves on water-meter inlets and outlets and valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

C. Water Meters: Install detector-type water meters in meter vault according to AWWA M6. Include shutoff valves on water-meter inlets and outlets and full-size valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

3.11 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water-meter installation according to utility company's written instructions and requirements.

3.12 BACKFLOW-PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers with relief drain in vault or other space subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support NPS 2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.13 VAULT CONSTRUCTION or INSTALLATION

A. See Section 033000 "Cast-in-Place Concrete" for concrete vaults.

B. Install precast concrete vaults according to ASTM C 891.

C. Connect drain outlet to storm drainage piping. See Section 334100 "Storm Utility Drainage Piping."

3.14 PROTECTIVE ENCLOSURE INSTALLATION

A. Install concrete base level and with top approximately 2 inches above grade.

B. Install protective enclosure over valves and equipment.

C. Anchor protective enclosure to concrete base.

3.15 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.

C. AWWA-Type Fire Hydrants: Comply with AWWA M17.

D. UL/FM-Type Fire Hydrants: Comply with NFPA 24.

3.16 FLUSHING HYDRANT INSTALLATION

A. Install post-type flushing hydrants with valve below frost line and provide for drainage. Support in upright position. Include separate gate valve or curb valve and restrained joints in supply piping.

B. Install ground-type flushing hydrants with valve below frost line and provide for drainage. Install hydrant box flush with grade. Include separate gate valve or curb valve and restrained joints in supply piping.

C. Install sampling stations with valve below frost line and provide for drainage. Attach weather-resistant housing and support in upright position. Include separate curb valve in supply piping.

3.17 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install fire department connections of types and features indicated.

B. Install ball drip valves at each check valve for fire department connection to mains.

C. Install protective pipe bollards on as shown on the drawings of each freestanding fire department connection.

3.18 ALARM DEVICE INSTALLATION

A. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.

B. Supervisory Switches: Supervise valves in open position.
1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.
2. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.

C. Locking and Sealing: Secure unsupervised valves as follows:
1. Valves: Install chain and padlock on open OS&Y gate valve.
2. Post Indicators: Install padlock on wrench on indicator post.

D. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.

E. Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.

F. Connect alarm devices to building fire alarm system. Wiring and fire-alarm devices are specified in Division 13 Section "Fire Alarm."

3.19 POST HYDRANT INSTALLATION

A. Install post hydrants in pavement or with concrete anchor.

3.20 DRINKING FOUNTAIN INSTALLATION

A. Install drinking fountains anchored to concrete pavement or to concrete block.

3.21 CONNECTIONS

A. Piping installation requirements are specified in other Division 2 Sections. Drawings indicate general arrangement of piping and specialties.

B. See Division 2 Section "Utility Materials" for piping connections to valves and equipment.

C. Connect water-distribution piping to as shown on the drawings.

D. Connect water-distribution piping to interior domestic-water and fire-suppression piping.

E. Connect waste piping from drinking fountains to sanitary sewerage system. See Division 2 Section "Sanitary Sewerage" for connection to sanitary-sewer] piping.

F. Ground equipment according to Division 16 Section "Grounding and Bonding."

G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.22 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than 1-1/2 times working pressure or 200 psi for 2 hours.
   1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig . Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
   2. Test is to be observed by the utility engineer and report to be completed and submitted to Owner and Owner's Representative.

C. Fire Service Lines: Testing and reports of testing activities for any fire supply line or water line with hydrant shall be in accordance with NFPA 24. Test shall be observed by utility engineer.

3.23 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-service piping. Locate below finished grade, directly over piping. See Division 2 Section "Earthwork" for underground warning tapes.

B. Indicate that all underground lines outside building footprint, except lawn irrigation lines, shall be required to have a warning tape installed in the backfill between 6 inches to 24 inches below finished grade directly over piping.
   1. Metallic lines shall be identified with durable printed plastic warning tapes, minimum 3 inches wide with lettering to identify buried line below.
   2. Non-metallic pipes, other than gas lines, shall be identified by detectable warning tape, minimum 2 inches wide, with lettering to identify buried line below.

C. Permanently attach equipment nameplate or marker, indicating plastic water-service piping, on main electrical meter panel. See Division 2 Section "Utility Materials" for identifying devices.

3.24 ADJUSTING

A. Adjust drinking fountain flow regulators for proper flow and stream height.

3.25 CLEANING

A. Edit this Article as required by authorities having jurisdiction.

B. Clean and disinfect water-distribution piping as follows:
   1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
   2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.

3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or as described below:

   a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.

   b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.

   c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.

   d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

C. Prepare reports of purging and disinfecting activities.

D. After completing drinking fountain installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

E. Clean drinking fountains, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 33 12 00